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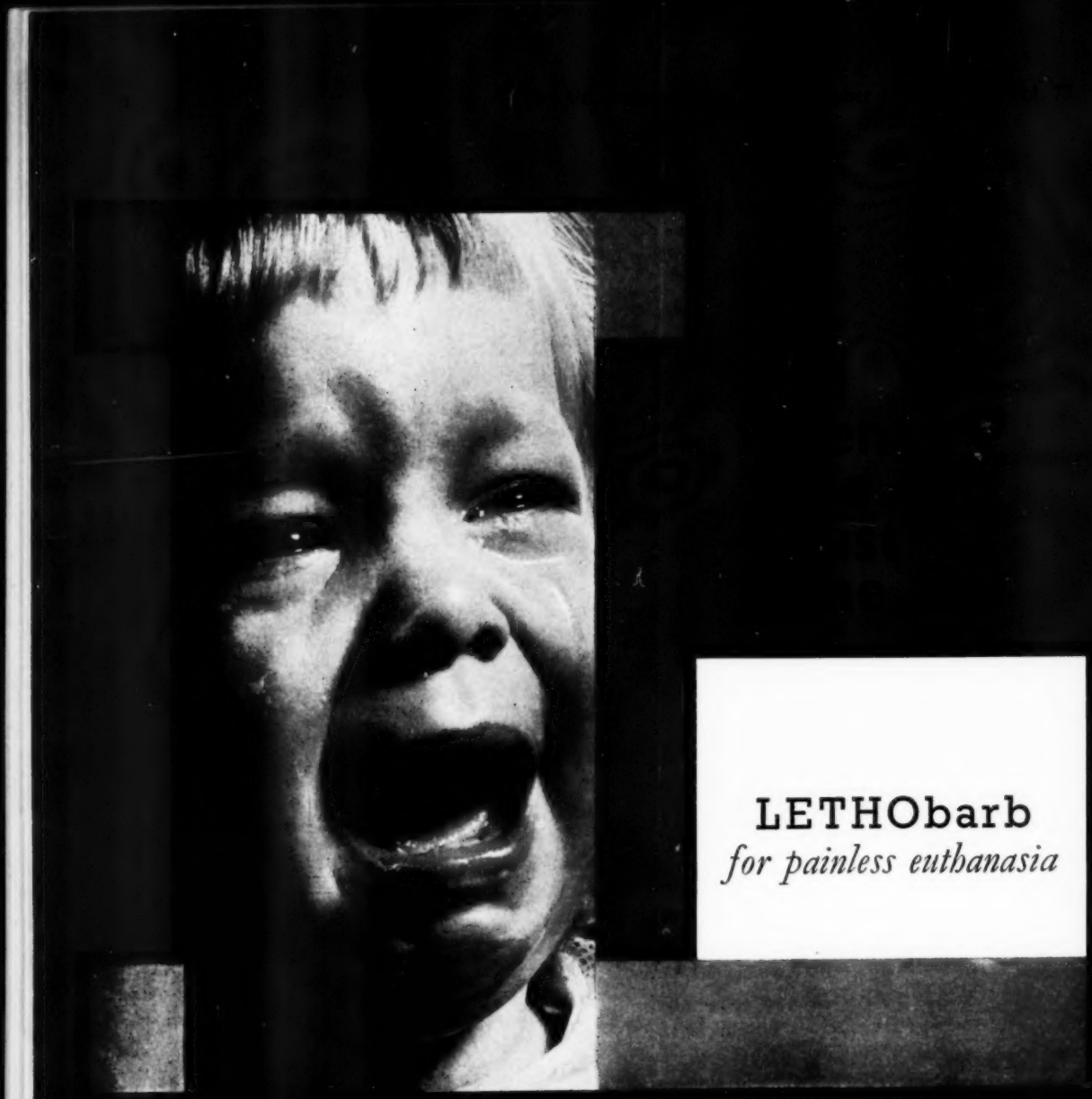
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SYMPOSIUM ON EQUINE PRACTICE

1.—Some Clinical Observations

BY

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I HAVE little doubt that the majority of practitioners in any way engaged in light horse practice will agree that the "footy" horse is one of their major problems. Under this term I propose to include the various manifestations of lameness in one or both fore feet, associated with degenerative changes in the pedal and navicular bones. The problem lies in the difficulty of all the 3 stages of diagnosis, prognosis and treatment and I propose to deal with them in this order.

Diagnosis

In the majority of cases one is presented with a hunter or hack, or 7 years of age or over, lame to a varying degree in one or both fore legs. To the owner there is nothing to account for it, so we are usually told, on entering the box, that it must be lame in the shoulder. I specify hack or hunter as I have the impression that horses kept exclusively for racing are less liable to this trouble. It is a difficult comparison to make, however, owing to the age incidence and the far greater wastage from tendon trouble in the latter type. An odd horse may be presented for examination younger than 7 years, but I believe that the majority of cases occur in the 8 to 10 age group.

There is considerable variation in the degree of lameness, ranging from what is often described as "a slight loss of action" with insidious onset to suddenly occurring acute lameness, but I fear that this is of little use in differential diagnosis as, contrary to what is described in some of the text-books, navicular disease quite often seems to have a fairly sudden, subacute onset.

There would appear to be 3 principal conditions affecting the bones of the horse's foot: firstly navicular disease, secondly pedal ostitis usually affecting the inner wing of the pedal bone but without marked ossification of the lateral cartilage, and thirdly ossification of the lateral cartilage or sidebone.

Navicular can start insidiously or suddenly in one or both feet. More often than not the foot is of a good shape and even after the condition has been in existence for some time, there need be no marked contraction of the heels. The hoof may show some heat but not to the same degree as one with pedal ostitis. I regard a marked flinch to thumb pressure in the hollow of the heel, as quite a good diagnostic aid. X-rays, of course, are very useful but should be used only in conjunction with other clinical findings, owing to the varying quality of plates and the occasional difficulty of interpretation: even when they are good, it is easy to make mistakes if relying on them alone.

Prognosis

When the difficulty of diagnosis has been overcome, prognosis and treatment are an equal headache. The former must be bad, though I do believe that a small percentage of very early cases heal if given a fairly lengthy rest. This healing may well be helped by vitamin D and B.12 injections and a mineral supplement such as bone-flour. Once the disease is established it becomes only a matter of time before the patient becomes unusable. We have at our disposal 2 methods of prolonging this period. Firstly we have treatment by cortisone or its derivatives. Without doubt the best results are obtained by direct injection into the navicular bursa. At first we used to do this through the tendon but now find it can be performed from the lateral aspect at coronet level without damaging the tendon. Results have been very variable, probably depending on the degree of ulceration present. Some of the most satisfactory have given a response lasting about 2 months, and in a very few the treatment has been repeated at such an interval for 2 or 3 times, after which we failed to get sufficient response to render the animal

* Papers presented to the Annual Congress of the British Veterinary Association in Oxford on Thursday, September 7th, 1961.

serviceable. What this boils down to from an owner's point of view, is that some cases can be kept going for an extra season's hunting and cortisone is, therefore, a useful weapon to have at our disposal when dealing with the "old favourite"; but it is doubtful if it is an economical approach in the average case. Systemic injections of cortisone would appear to be of little value, and the same applies to butazolidin therapy, as the response, even if adequate, is too short to be worth while.

Treatment

Now I must come to the controversial question of un-nerving. I believe it can be useful in a few selected cases. Firstly, I usually consider the case itself, as to its suitability for operation and then the circumstances surrounding it, before committing myself. The horse that is lame in one leg only seems to be a far better proposition than one that is "pottery" in both. The nerves that have to be sectioned vary slightly. Occasionally to section both the posterior branches of the plantar nerve in the low position is adequate, but more often I find it necessary to perform the high plantar on the inner side, and the posterior branch in the low position on the outer side. Obviously the greater area of the foot that is left with a nerve supply the better, and by leaving even only 2 of the 6 branches the dangers of undetected injury or degeneration seem to be very slight.

When a foot has been only partially un-nerved the horse seems to move perfectly well and I have not noticed any greater tendency to stumble or fall than in a sound animal. Many cases have been able to perform perfectly satisfactorily for a season or two, after which trouble often arises in the other foot or an extension of the disease process in the partially un-nerved one causes lameness to recur. Other trouble has been a fairly frequent tendency to overreach on to the heel of the affected foot.

I feel that one can summarise the question of navicular by saying that any treatment is generally unsatisfactory and it is really very doubtful if either cortisone therapy or un-nerving are often worth while.

Pedal ostitis in various forms is also responsible for a large number of horses suffering from chronic foot lameness each year. Generally the history of the case is that the animal was slightly lame for a few days with nothing to show and then becomes sound, but lameness recurs on being put back to work. Often after one or two goes like this, the lameness becomes more long lasting and possibly permanent. Heat in the foot is usually fairly obvious and there may be a sensitivity to percussion though seldom to squeezing. Quite frequently a corn is present and it is only when treatment for this fails to relieve the lameness that bone trouble is suspected. It seems quite possible that the inflammatory process of a long standing corn may easily spread to the wing of the pedal bone, resulting in oesteophytic outgrowths. Lameness is generally persistent with no tendency to "warm up" with exercise.

Treatment again is very difficult, and when once the disease is well established the prognosis is most grave. The earlier the condition is recognised the more likelihood there is of the animal becoming and staying sound. Rest is essential and nothing seems to answer as well as to have the patient turned out in a soft marshy field. If all goes well and he becomes sound and returned to work, great care must be taken to try to minimise the predisposing causes and also to keep the horn as soft as possible.

Another type of inflammation affecting the pedal bone involves the pyramidal process, usually associated with trouble on the front of the short pastern bone and the joint surface between them. This also is extremely serious and it is doubtful if many patients do much work when thus affected, even though the amount of lameness is very variable. Diagnosis is usually fairly easy from the swelling under the coronet, and is easily confirmed by a lateral X-ray. In theory cortisone or allied drugs may be useful in the early stages by reducing the inflammation more quickly and thereby reducing the amount of deposit on the bone, but in practice they seem to be of very limited value. At this stage one perhaps should mention the condition of chronic and subacute laminitis. This, of course, is well known and recognised in the fat pony, but some cases of subacute soreness in the feet of larger horses, without any demonstrable bony lesions, may well fall into this category. Fortunately they are usually of quite a temporary nature and seldom cause any serious trouble.

Lastly we have the condition of "sidebones" or ossification of the lateral cartilages, which ultimately affects quite a high percentage of hunters and an even larger one of show jumpers. Firstly it must be admitted that a large number of horses have quite large sidebones without ever having been lame. On the other hand, quite a small amount of ossification may lead to lameness especially in its initial stages. When the condition is uncomplicated by inflammation of the wing of the pedal bone, prognosis seems to be quite good and treatment other than the usual rest unnecessary. When the sidebones are large and seem to bulge over the coronet and cause persistent lameness, hoof grooving seems to be useful but this is the only condition in which it appears worth while. Three vertical groove at the heel on each side from coronet to sole and cut nearly into the sub-horny layer seem to give the best results. It is quite a delicate job to get the groove deep enough at the coronet but the time and trouble are worth while.

Aetiology

The aetiology of these various conditions remains largely obscure but certain pointers appear from the clinical aspect which are worth considering from a preventive point of view. Concussion must be the biggest single factor involved and the high percentage of road work that hunters and hacks must do nowadays ensures that they are subject to this influence for a considerable part of their working lives. Here one might mention that the thoroughbred racehorse, who does only a small part of his

(*Concluded at foot of facing page*)

2.—Clinical Aspects of Equine Brucellosis

BY

J. S. MAXIE COSGROVE

The Riversdale Clinic, Palmerstown, Co. Dublin.

SUMMARY.—By serum examinations we have identified agglutination titres of Brucella abortus *antigen in horses. We suggest*:

(1) *that the significant titres in bovine animals as published by Laing are applicable to the equine species.*
(2) *that structures other than the ligamentum nuchae may be affected.*
(3) *that Strain 19 vaccination is an effective, cheap and frequently spectacular treatment.*
(4) *that the nature of the reaction to vaccination is in itself diagnostic.*
(5) *that the condition, when occurring in the navicular bursa, may be confused with true inflammation of the navicular bone.*
(6) *that acute and mild infections with* Brucella *do occasionally give rise to symptoms not unlike those described in undulant fever of man.*

THE incidence of *Brucella abortus* in horses has had sparse reference in recent literature, and other than brief references to the actual organism being recovered from isolated and localised lesions, we cannot recollect having come across serum examination records pertaining to equine *Brucella abortus*; but we qualify the latter remark by stating that the number of useful references to which we have had recourse has been limited.

Hagan & Bruner (0000) state, "it has been found in hygromas of the knees of cattle and in inflammation of bursae located beneath the 2 attachments of the ligamentum nuchae in horses," and that "there is evidence to suggest that it plays a role in the initiation of processes in these bursae which eventually result in the condition generally known as 'fistula of the withers and poll evil'."

Hutyra, Marek & Manninger (1938) in their exten-

Some Clinical Observations.—*Concluded.*

work on the roads and then only at the walk or steady trot, seems far less likely to suffer from "footy" trouble than his brother of equal age used for hunting. Directly involved with the question of concussion is the problem of shoeing and one has the impression that many cases of pedal ostitis are associated with the use of one or other of the types of anti-slip stud now so commonly used in the fore shoes. These, by stopping even the very slight amount of slide when an ordinary shoe hits the ground, are going to throw quite a lot of extra shock into the foot. Then we are all too often up against the shoe that is left on too long so that its heel comes to lie in the seat of corn, causing considerable bruising which, as I have mentioned before, may spread to the bone.

Show jumpers, apart from the usual cases of navicular and pedal ostitis, seem particularly prone to get trouble from ossification of the lateral cartilages and frequently quite large sidebones are produced. Many of these horses do comparatively little road work and, therefore, we can assume that it is the result of the jumping which all too often seems to be on very hard ground. When the trouble involves the pyramidal process of the pedal bone, direct trauma must be a major cause, as when a horse hits solid timber or walls with the front of its feet when jumping. In the worst cases the bone is not infrequently fractured.

Breed and heredity now come into it. The thoroughbred and half bred hunter seem far more susceptible than the pony, who does just as much road work. There seems to be little evidence to support navicular disease being classified as a hereditary disease either directly or from a susceptibility in the natural make and shape of the foot, as more often than not it appears in a horse with a very good foot. Pedal ostitis, however, may affect the naturally weak foot more easily and it is noticed how often the French thoroughbred, whose feet generally speaking are not so strong as those of horses bred in England or Ireland, tend to go "footy" after being trained in this country for a time.

When it comes to navicular disease it is far more difficult to provide a satisfactory explanation as it is difficult to see how concussion can have any bearing on the tendinous surface of a bone that is not directly involved in the bony supporting column of the limb. We must remember, however, that considerable pressure must be applied to this surface by the flexor tendon and in a few extreme cases is enough to fracture it. It seems reasonable to assume, therefore, that there must be many more cases where the lesser damage of bruising occurs. Nutritional factors may well be involved but are somewhat outside the scope of this discussion.

In conclusion one might make the point that we have been dealing with one of the few fields of veterinary medicine and surgery where the art of diagnosis and prognosis still take pride of place over the science, though one has to admit that the latter is making great advances and we shall look forward to the day when it enables us to treat chronic lameness in the horse's foot with far greater confidence than, I fear, we are able to do to-day.

TABLE I
BRUCELLA ABORTUS TITRES (EQUINE)

Date	Identity	Dilutions									Condition	Result of Vaccination
		1/10	1/20	1/40	1/80	/160	1/320	1/640	1/1280	1/2560		
Number 1 April 4th 1956	5-year-old T.B. filly	+	+	+	−	−	−	−	−	−	Navicular bursitis	Complete recovery
Number 2 August 29th 1956	"Sentina" chaser	+	+	+	+	−	−	−	−	−	Perforatus Sheath	,,
Number 3 November 13th 1956	Chaser	+	+	+	+	+	+	−	−	−	Navicular bursitis	,,
Number 4 November 22nd 1956	"Silken Glider"	−	+	+	+	+	−	−	−	−	Perforatus sheath	,,
Number 5 November 27th 1956	T.B. yearling	+	+	+	−	−	−	−	−	−	Stifle	,,
Number 6 April 23rd 1957	Hunter	+	+	+	−	−	−	−	−	−	Navicular Bursa	,,
Number 7 June 20th 1957	Brood mare pregnant	−	−	+	+	+	+	+	+	−	See special description	Incomplete
Number 8 July 11th 1957	Brood mare pregnant	−	−	+	+	+	+	+	+	+	See special description	Incomplete
Number 9 August 24th 1957	Brood mare pregnant	−	−	+	+	+	+	+	+	+	Special See description	Incomplete
Number 10 September 24th 1957	Brood mare pregnant	−	−	+	+	+	+	+	+	+	See special description	Incomplete
Number 11 July 3rd 1957	Hunter	+	+	+	+	+	−	−	−	−	Shoulder lameness	Complete recovery
Number 12 July 22nd 1957	Hunter mare	+	+	+	−	−	−	−	−	−	Navicular bursae	,,
Number 13 August 8th 1957	Yearling	+	+	+	−	−	−	−	−	−	Stifle	,,
Number 14 August 14th 1957	Pony	+	+	+	+	−	−	−	−	−	Navicular bursae	,,
Number 15 August 14th 1957	Hunter	+	+	+	+	−	−	−	−	−	Hindquarter	,,
Number 16 September 9th 1957	Racehorse (flat)	−	+	+	+	−	−	−	−	−	Carpal bursa	,,
Number 17 September 24th 1957	Racehorse (flat)	+	+	+	−	−	−	−	−	−	Bicepical bursa	,,
Number 18 November 30th 1957	T.B. mare	+	+	−	−	−	−	−	−	−	Navicular bursa / Digital sheath (hind.)	No improvement

TABLE I—*continued*

Date	Identity	Dilutions									Condition	Result of Vaccination
		1/10	1/20	1/40	1/80	1/160	1/320	1/640	1/1280	1/2560		
Number 19 July 24th 1957	Brood mare pregnant	+	+	+	+	−	−	−	−	−	Digital sheath Not vaccinated Hydrocortone	Relapsed at intervals
Number 20 February 19th 1958	T.B. yearling	+	+	−	−	−	−	−	−	−	Stifle	Complete recovery
Number 21 June 3rd 1958	Racehorse (flat)	+	+	+	−	−	−	−	−	−	Carpal bursa	,,
Number 22 September 9th 1958	Chaser	+	+	−	−	−	−	−	−	−	Side bones and Navicular bursa	No improvement
Number 23 October 17th 1958	Showhorse	+	+	−	−	−	−	−	−	−	Perforans sheath	,,
Number 24 October 17th 1958	Chaser	+	+	−	−	−	−	−	−	−	Navicular bursa	Complete recovery
Number 25 November 27th 1959	Pt. to Pt. gelding	+	+	+	+	+	+	−	−	−	Slight intermittent temperature	,,
Number 26 April 2nd 1960	Show-jumper	+	+	+	+	−	−	−	−	−	Cervical bursitis	,,
Number 27 May 20th 1960	Corrig Neagh	+	+	+	−	−	−	−	−	−	Perforans sheath both fore	,,
Number 28 May 3rd 1960	"Sentina"	−	−	+	+	+	+	+	−	−	Strained perforatus tendon. Vaccination titre—see No. 2	No treatment
Number 29 April 15th 1960	Hunter mare	+	+	−	−	−	−	−	−	−	Navicular bursitis	Complete recovery
Number 30 June 14th and August 7th 1960	3-year-old Racehorse	+	+	±	−	−	−	−	−	−	Both fore perforans sheaths	,,
Number 31 June 2nd 1960	Yearling	+	+	+	+	+	+	−	−	−	Cervical bursitis	,,
Number 32 July 23rd 1960	Bay hunter	+	+	+	+	−	−	−	−	−	Navicular bursitis	,,
Number 33 August 14th 1960	3-day event mare	+	+	−	−	−	−	−	−	−	Carpal bursitis	,,
Number 34 November 12th 1960	Racehorse	+	+	−	−	−	−	−	−	−	Perforatus sheath	,,
Number 35 November 14th 1960	Pt. to pt. gelding	+	+	−	−	−	−	−	−	−	Navicular bursitis	,,

TABLE I—*continued*

Date	Identity	Dilutions									Condition	Result of Vaccination
		1/10	1/20	1/40	1/80	1/160	1/320	1/640	1/1280	1/2560		
Number 36 October 28th 1960	Show jumper	+	+	+	±	−	−	−	−	−	Perforatus sheath	Complete recovery
Number 37 December 22nd 1960	3-year-old potential chaser	+	+	+	+	+	+	−	−	−	Stifle	,,
Number 38 January 9th 1961	T.B. 2-year-old	+	+	±	−	−	−	−	−	−	Contracted tendons—humanely destroyed	No treatment
Number 39 March 3rd 1961	3-day event. gelding	+	+	+	−	−	−	−	−	−	Thoroughpin not lame	Improved
Number 40 May 9th 1961	Barren brood mare	+	+	+	−	−	−	−	−	−	Hindquarter	Improved
Number 41 January 2nd 1961	T.B. yearling	+	+	+	+	−	−	−	−	−	Stifle	Complete recovery

26 Positives, 24 vaccinated, all recovered or made considerable improvement.
11 Doubtfuls, 10 vaccinated, 3 recovered or made considerable improvement.
NOTE : 7, 8, 9, 10 refer to same mare ; 2 and 28 refer to "Sentina".

sive publication give just over 1 page to the subject, notwithstanding the fact that they record the confirmation of the existence of the disease in Germany by Schoop, Hieronymi and Gilde; in France by Rossi; in Holland by van der Hoedan; in Sweden by Hulten, Magnusson and Wall; in Hungary by Jesina and Hajdu; in Russia by Makkewejsky; in Britain by Duff; and in the U.S.A. by Fitch. They summarise by commenting that the disease is almost exclusively of surgical interest but noticed that Schoop (Germany) reported favourably on vaccine treatment.

It is of interest to note that the Russian horse-purchasing commission which visited England and Ireland last year sought blood serum agglutination tests of horses they bought.

Our interest in the condition has slowly developed from as far back as 1947, and it was aroused in seeking an explanation for the cause of chronic and frequently intermittent lameness, which by digital nerve block, we located in the hoof; but by X-ray and other means we were unable to demonstrate the precise causal factor.

During the following 9 years we had many serological examinations carried out by different laboratories whose interpretations were expressed in terms of "positive" or "negative" findings; consequently, we have no records as to the actual agglutination levels on which interpretations of the test were made. We are, therefore, disregarding any cases before June, 1956 at which date we set up our own diagnostic laboratory under P. J. McDonnell, F.I.M.L.T., formerly senior technician of the Mater Hospital, Dublin.

With one exception, our experiences have been with localised inflammation in bursae or sheaths but never in a true articular cavity. The varying degrees of inflammation noted from acute to mild in affected structures do not appear to be related to exercise or rest and will often disappear and recur without ascertainable cause. However, we have noted that during these intermissions affected bursae rarely completely regain their normal anatomical alignment but have a flaccid or baggy appearance and feel. The associated pain factor, of course, is in direct relation to the inflammation, with the qualification that it would appear to be much more noticeable in bursae, rather than in sheaths. This is particularly true of the limbs where the lameness associated with bursal inflammation is marked, whereas a similar degree of inflammation in a sheath may give rise only to slight discomfort.

While we admit we have never isolated the organism from any lesion or set up the condition experimentally, we are completely satisfied that brucellosis is an important disease factor in both the Thoroughbred and the hunter. We base this contention on our serum findings and on the response we have obtained to vaccine therapy. In the period under review we, together with some colleagues who use our laboratory facilities, have had 249 sera from suspected cases tested, and found 26 positive, 11 doubtful and 209 negative. This latter figure would indicate that our margin of error in clinical diagnosis is great, but we beg to be believed when we say we have used this test rather extravagantly and occasionally without justification. However, we believe it possible

that *Brucella abortus* has a significance in equine animals far beyond the limits of our investigation. It is reasonable to suggest that the infection is picked up during mixed grazing with cattle, and we are coming round to the idea that some of these bouts of unexplained fever so common in young Thoroughbred and hunter stock may perhaps be primary *Brucella abortus* infections.

While in the majority of cases under review (see tabulated list) lesions seem to be confined to certain bursae and tendon sheaths, it is conceivable to us that any bursae or tendon sheath in the body may become affected. The commonest sites are the navicular, carpal, stifle and cervical bursae; superficial and deep tendon sheaths of both limbs, and the digital and synovial sheath (windgalls) of the hind limbs. We have also come across cases of chronic fore and hind limb lameness, giving positive titres which by a process of elimination we assume is located in either the shoulder or hip. It seems probable that some of the deeper bursae situated in these areas may also be affected.

The degree of distension and inflammation in affected sheaths and bursae is frequently not constant over a period of days, and occasionally may change in a matter of hours; this latter short period is particularly noticeable in the flexor tendon sheaths. Where bursae on 2 or more limbs are affected the condition is liable to give rise to a shifting lameness from one limb to the other and is often a source of confusion and embarrassment to either client or veterinary surgeon. There may also be a history of long intermission between lamenesses during which all evidence of inflammation is indiscernible in sheaths and bursae.

It is usual to find both forefeet navicular bursae involved, and horses so affected will perform reasonably well when "warmed up" but their action is always short and "crabby" particularly when first taken from the stable. At rest they shift the weight on their limbs, pointing one foot and then the other.

We are confident that many of these cases are diagnosed as true navicular, but it is to be noted that the characteristic high-heeled boxy hoof is not a feature of this disease. In fact, the reverse is sometimes the case—the condition being found in horses with little or no heels, allowing excessive pressure.

Inflammation and distension of the sheaths of the perforans and perforatus tendons may be so intense that one could not be faulted in diagnosing a bowed or strained tendon. One's suspicion becomes aroused, when there is no history of recent strong exercise, by its rapid response to near-normal under antiphlogestic treatment and its reoccurrence without sufficient cause.

Three most spectacular cases in this category were "Silken Glider," No. 4, "Sentina," No. 2 and "Corrig Neagh," No. 27.

"Silken Glider" was treated as a 2-year-old; she subsequently won the Irish Oaks, and was second in the English Oaks as a 3-year-old. "Sentina" was one of the most outstanding Irish chasers in the last 4 years, winning many top races both in England and Ireland. "Corrig Neagh" was a member of the Irish-3-day Event, Olympic Team, and it is interesting to record that the condition was diagnosed in him by T. A. R. Filgate, M.R.C.V.S., on May 20th, 1960, and the horse was one of the few starters at Rome in September, 1960, who completed all 3 departments of the test, viz. dressage, cross-country and show-jumping.

Cervical bursitis we have seen in a Thoroughbred yearling No. 31 in June, 1960; she later was sold in the yearling sales for 1,000 guineas. This filly showed a marked rigidity of her neck, found difficulty in grazing and resented manipulation of the mid-cervical region. We also saw a more advanced case in a show jumper, No. 36. Here there was a hot inflammatory area in the cervical area immediately in front of the withers.

While we have seen a number of cases of bursitis of the stifle, 2 that interest us most are No. 37 in an unbroken 3-year-old potential chaser, and a Thoroughbred yearling filly No. 41. Each of these had been affected with the "viral coughing" we had last winter, and about 10 days subsequent to their apparent complete recovery each went lame of the stifle as evidenced by a marked hot inflammatory distension of the stifle.

This suggests to us that the organism may lie dormant and only become active as a result of lowered resistance and it further suggests to us that it is not unlikely that the organism may be a factor in so-called "joint ill" in older foals.

The positive titre in case No. 38 may have been coincidental with the contracted flexor tendons which were so advanced that we advised humane destruction. Unfortunately, owing to a misunderstanding, we did not have an opportunity to carry out a *post-mortem* examination; in the future we intend serum testing such affected horses.

The exception we noted early was case No. 7 in which the symptoms resembled very closely those described during the stages of undulent or Malta fever in man. This occurred in a brood mare, 10 weeks pregnant and suckling her third foal. She was first noticed stiff across her loins and it was assumed she had a fall in the paddock. Her temperature, pulse and respiratory rates were normal, all being checked on three successive mornings. On the fourth examination made during the afternoon, she was noted to have a temperature of 105°F., with marked muscular weakness, particularly of the hindquarters This case was treated successfully with broad spectrum antibiotics over a period of 3 weeks, but we are satisfied that had we not given supportive cortisone therapy we should have lost this mare on account of severe progressive muscular weakness. We are further satisfied that had we had afternoon temperature checks earlier in our treatment, the case may not have reached such an advanced stage. It is interesting to note that the foal this mare was suckling, although tested on a number of occasions, never showed even a doubtful titre. Her gestation

period was subsequently full term and her foal the following year did not show a titre.

Temporary relief from symptoms, or from symptoms in the localised form, may be obtained for indefinite periods by injecting sheaths and bursae with hydrocortone and neomycin. This therapy is extremely useful in that the response is rapid allowing the horse to fulfil some pressing engagements; but in our hands Strain 19 vaccine would appear to have given us spectacular permanent recoveries in uncomplicated cases and is of course a relatively cheap treatment.

In our laboratory our technique is similar in every respect to that employed in the serum agglutination test for *Brucella abortus* in cattle using Standard Agglutinable Suspension (*Brucella abortus*). We believe that it is extremely important to use standard laboratory technique and interpretations—and we are satisfied that those suggested by Laing (0000) are applicable to horses, viz.

No agglutination, or agglutination only at a dilution of 1 : 10—negative.

Agglutination at dilutions up to 1 : 20—indefinite.

Agglutination at dilutions of 1 : 40 and above—positive.

To the above interpretations we can confidently add that the nature of the immediate reaction both local and systemic to vaccination with Strain 19 is also diagnostic as to whether one is dealing with brucellosis in an individual.

In titrating a serum, it is sometimes found that the tubes containing the largest amount of serum may show little or no agglutination. This zoning phenomenon is commonly found in Brucella agglutination tests, and was not infrequently encountered in the present series of tests. The exact cause of zoning is not clearly understood, and has been variously attributed to the presence in the serum of some substance, possibly a protein other than globulin, which prevents clumping, but which is diluted out in lower concentrations, or to a too wide departure from the optimum proportion between antigen and antibody. According to more recent work in human brucellosis (Zinneman, Glenchur & Hall, 1959) the zoning phenomenon appears to be related to the presence in the serum of a specific "blocking" antibody. The existence of these zones of inhibition is a matter of some practical importance, and care must be taken to employ serum dilutions sufficiently high to obviate the possibility of the presence of zoning being mistaken for a negative reaction.

With many of the indefinite serum agglutinations of 1 : 20, we have repeated our tests at fortnightly or monthly intervals, but have not come across a rising titre. In these cases we now do not repeat examination but vaccinate and depend on the immediate vaccination reaction for diagnosis.

We have administered Strain 19 vaccine from varying sources using a single dosage of 5 ml. in adult horses and down to 2 ml. in Thoroughbred yearlings, but are under the impression that freeze-dried vaccines (Philips-Duphan, 0000) are better tolerated locally and are less liable to abscess formation at the site of inoculation.

As mentioned above confirmation of laboratory findings is very obvious on vaccination. In affected horses a very severe febrile reaction commences within 12 hours, there is patchy sweating, markedly increased pulse and respiratory rates, injected mucous membranes and occasionally "pawing" with either forefoot. There is complete inappetence for the first 24 hours, and although tenderness is noted at the site of the inoculation, within a couple of hours the region becomes intensely inflamed and plaque-like between the 24th and the 48th hours, with a gradual subsistence to near normal at 96 hours. (It is advisable to take care to vaccinate subcutaneously and to massage the area for some 2 to 3 minutes, in order to minimise abscess formation.)

In the occasional case where we have inoculated on indefinite laboratory findings and where incidentally no improvement in the condition under treatment was noted, the local and systemic reactions were extremely mild. Apart from slight tenderness associated with a rise of 1°-2°F. in temperature and perhaps partial inappetence for about 24 to 36 hours, the reaction might easily go unnoticed by an uninformed observer.

Some improvement may be noted within 7 to 10 days post vaccination but complete recovery may require 21 days.

An occasional case may take even longer, this being particularly noticeable with the navicular bursa, the probable explanation being that the confinement within the hoof does not permit even the slightest distension without pain. In the localised form, loss of condition is not a feature, in fact many of the patients were in great condition and bloom.

Acknowledgments.—To my partners James Kavanagh, Sean Collins and Stan Cosgrove in confirming that this paper is as much theirs as mine. To our technician Patrick McDonnell, without whose help our practice would be very much poorer. To our colleagues in practice who avail themselves of our laboratory services.

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3.—A Review of the Therapeutic Use of Corticosteroids in Equine Lameness

BY

Lt. Col. J. H. WILKINS*

SUMMARY.—In the horse almost every condition of the legs causing lameness has traditionally been treated, after a preliminary poulticing, bandaging and rest, either by blistering or firing. These are still the most commonly used techniques. It is conceded that in chronic lesions and exostoses firing may be the only resort. However, many people believe that firing is a trifle brutal and to be avoided except in exceptional cases. The real advantage is often the enforced rest which the trauma calls for. A review of the literature, reinforced by limited personal experience, suggests that by using hydrocortisone plus antibiotics injected into synovial cavities many early cases of lameness due to joint and bursal inflammations, or injuries, can be cured or at least so improved as to reduce the necessity for firing. There is an understandable reluctance in entering a joint cavity and no doubt the technique is more skilled than is generally believed. However, accurately placed peri-articular injections are often of greater usefulness. Systemic corticosteroid therapy has a limited place in mono-articular conditions but is a useful adjunct to treatment in vague high lameness. Further research into the whole subject as far as the horse is concerned is necessary.

Preamble

STARKEY (1960) divides the readers of scientific publications into:—

(a) the Casual Reader is one who subscribes to a publication but does not necessarily read it.
(b) The Inveterate Reader seldom subscribes but somehow manages to read most publications with a view to asking silly questions at meetings of learned societies.
(c) the Informed Reader is the reader of literary digests.

There is no doubt that the pattern of scientific literature is becoming more confused every day and the incidence of immature and undifferentiated papers is on the increase. Moore (1962) predicts that this tendency will increase in the years to come and this paper will undoubtedly add weight to his views. It is presented with humility and with a conviction that grandma is being forced to listen to a lesson in the art of sucking eggs. We intend to carry on regardless! At least the references may be of use to those who are interested.

Review of the Literature

Hollander *et al.* (1951) introduced the intra-articular injection of hydrocortisone in the treatment of arthritis in man. Between 1952 and 1955 Wheat (1955) became the first worker in the veterinary field to inject steroids into the synovial cavities of horses to treat various kinds of lameness. His results for 91 cases included 53 (58 per cent.) cures, 33 (36 per cent.) improvements and 5 (6 per cent.) failures. Of these 5 failures: one was the only navicular case treated, and 2 were old-standing chronic osteo-arthritic cases. Another pioneer in the field was Proctor (1955), who used the treatment in very many cases of synovitis of joints and bursae with success. Hayes (1954) reported successful treatment of 2 cases of coxitis. He used a 2-inch, 13-gauge needle which was inserted at right angles to the skin surface 5 to 8 cm. below the greater trochanter and 3 cm. anterior to the trochanteric ridge. Then a 5-inch, 18-gauge needle was pushed through the first needle into the coxo-femoral joint capsule and 5 ml. (125 mg.) hydrocortisone was injected.

Crane (1956) listed 3 factors in selecting cases for intra-articular injection of hydrocortisone in horses:

(i) the lameness should be traumatic in origin. Conformation should not be the underlying cause.
(ii) good supporting measures must be used in treatment.
(iii) a guarded prognosis should be made.

Riley (1956) used the treatment on "a great many cases" of acute and chronic lameness in horses. Results were "good to excellent" in the majority of acute cases. Chronic cases as a rule did not respond so satisfactorily, particularly where proliferative changes were evident on X-ray.

Dillon (1956) used intra-articular injections of fluorohydrocortisone on 5 cases of synovitis, 3 of the carpus and 2 of the fetlock. All 5 were cured.

Wilkins (1957) used the method fairly extensively and introduced a simple technique for the intra-articular injection of hydrocortisone in the treatment of certain selected cases of navicular disease (1959). Of 31 horses so treated between 1956 and 1959 ten (32 per cent.) recovered, and 21 (68 per cent.) showed varying degrees of improvement. Bishop (1960) extended these figures: he treated 22 cases of navicular disease of which 16 (73 per cent.) made clinical recoveries and 5 (27 per cent.) showed no apparent improvement.

Bordet *et al.* (1958) after aspiration of excess synovia injected 2.5 ml. to 5 ml. of a 2.5 per cent. solution of hydrocortisone plus 100,000 units of penicillin into synovial cavities of horses suffering from hydroarthrosis and chronic synovitis. Results were uniformly excellent. Dietz *et al.* (1959) cured 7 out of 8 horses suffering from infected synovitis of various joints and bursae with intra-articular injections of hydrocortisone plus nebacetin. The remaining animal was sound for over a year but became

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lame subsequently. Other recent German papers seen on joint and bursal conditions stress only the conventional traditional treatments (Schebeitz, 1958; Jirina, 1959; Fredenberg & Gessner, 1959) and there may be a reason for this.

Quinlan (1959) reported 69 per cent. clinical recoveries in the treatment of 113 cases of various kinds of joint and bursal lameness in horses, using intra-articular injections of hydrocortisone. In bursal enlargements where excessive synovia secretion occurred he found that an injection of a combination of prednisolone plus hyaluronidase proved to be effective. He also used prednisolone in a dosage of 200 mg. intramuscularly in 4 cases of high lameness (shoulder, hip, elbow and stifle) and had recoveries in all cases.

Asheim *et al.* (1959) treated 4 cases of subacute/chronic laminitis and 4 cases of acute laminitis by the intramuscular injection of 500 mg. hydrocortisone daily for 3 days. All acute cases, and 3 out of 4 of the chronic cases responded successfully. Lawson (1954) was one of the first to report the complete cure of acute laminitis following the injection of 50 international units of ACTH.

Temple (1960) treated various joint and bursal conditions in racehorses with intra-articular injections of fluoroprednisolone. Practically all were returned to training subsequently. Dosage varied between 4 mg. and 7 mg. into synovial cavities, and 10 mg. intramuscularly. Responses fell into the "good to excellent" categories.

Kottman and Krul (1960) carried out experiments on 86 horses. They injected 344 joints. Penicillin was the antibiotic of choice. This was also the conclusion of Kulczycki (1957) who had 11 cures out of 14 cases of acute pyogenic infection of joints and tendon sheaths in horses.

Larrazabal (1959) used intra-articular and intramuscular injections of prednisolone on 34 cases of joint disease in Thoroughbred horses in Venezuela. Results were highly successful. No signs of renal dysfunction were observed in those cases receiving prolonged treatment. In many horses he employed the corticosteroid combined with vitamins A and D either with or without additional injections of ACTH.

Vigue (1960) treated 59 inflamed joints of horses with 25 to 200 mg. prednisolone trimethylacetate, a long-acting corticosteroid, injected intra-articularly. The average number of injections per joint varied between 1.4 and 2.5. Forty-one (69.5 per cent.) had an "excellent" outcome, 5 (8.5 per cent.) were "good," 3 (5 per cent.) were fair and 10 (17 per cent.) failures. Of these 10 failures, 5 were due to a faulty technique and the steroid is exonerated. He also had 100 per cent. cures in 7 cases of acute laminitis, and 5 out of 6 cures in cases of lymphangitis using 250 mg. to 500 mg. of the product intramuscularly.

Pitman (1960) used dexamethasone on a large number of cases of equine lameness. He found it very effective: —

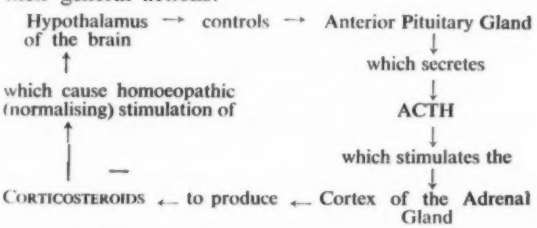
(i) by the oral route where a 5 mg. bolus was given twice a day for 3 days.
(ii) intramuscularly using a 10 mg. dose.
(iii) intravenously using a 5 mg. dose.
(iv) intra-articularly using a 6 mg. dose.

The functional status of the affected joint, tendon and associated structures was restored and maintained. Horses were able to continue racing in cases previously classed as fairly hopeless.

The Action of Corticosteroids

The value of any therapy to the busy general practitioner depends entirely upon its performance under clinical conditions. It must be efficacious, easy to administer and safe. It is the intention of this paper to put forward evidence that the adrenal corticosteroids fulfil these criteria in many conditions causing lameness in horses.

The important and related subjects of the physiological and biochemical mechanisms of action of these products have been dealt with extensively in recent reviews (Uvarov, 1959; Fitzpatrick, 1961). For our purposes we need go no deeper into this aspect than to illustrate the natural production of the corticosteroids by a simple diagram with a note on their general actions:



Corticosteroids are liberated into the blood-stream from the adrenal cortex. Their release is stimulated by ACTH from the anterior pituitary gland, which itself is controlled by the hypothalmus of the brain; finally, to complete the circle, the latter is sensitive homoeopathically to corticosteroids. Their physiological action is predominantly either (1) on mineral metabolism affecting the electrolyte balance of the body. These are known as mineralocorticoids, *e.g.* DOCA and aldosterone, or (2) on carbohydrate metabolism when they are known as glucocorticoids.

The only corticosteroids used therapeutically in lameness in the horse are the *natural* glucocorticoids (cortisone and hydrocortisone) and the *synthetic* glucocorticoids (prednisone, prednisolone and fluoroprednisolone). The general actions of these products which are of interest to the clinician, in descending order of importance in our limited context are: —

(i) anti-inflammatory action, in which the basic processes of inflammation are suppressed.
(ii) neurological effects, with apparent analgesic actions.
(iii) gluconeogenesis helping to maintain muscular efficiency.
(iv) immunological effects including anti-allergic actions.

We are mainly concerned with the anti-inflammatory and apparent analgesic effects. When injected into joint and bursal synovial cavities the corticosteroid reduces oedema, synovia formation and subse-

quent fibrosis and pain. As there is a side effect in also suppressing the antibacterial action of the tissue, thus allowing spread of infection, the addition of a suitable antibiotic is essential. In the horse, injections of corticosteroids systemically cause a decrease in circulating histamine to which is attributed a peripheral eosinopenia (Archer, 1957). The antiphlogistic effects of corticosteroids are considered to depend on the length of time they are in contact with the damaged tissues and so the less soluble they are in synovial fluid the more enhanced is their anti-inflammatory effect.

Joints and Bursal Conditions

The mechanism and lubrication of mammalian joints have been the subjects of research for many years (MacConnail, 1932; Lewis & McCutchen, 1959). The synovial fluid between the articulating surfaces of a joint is extremely scanty. It has been calculated for the knee joint of the sheep as equivalent to a layer no greater than half a micron thick. This fluid is at very high pressure and the only way that this layer can be maintained is perhaps by a process called by McCutchen (1960) "weeping lubrication," which automatically pressurises the sponge-like reservoirs in the articular cartilages which hold and supply the synovial fluid. Gentle contact occurs between the opposing surfaces of the joint at a few high spots. In the horse, which spends so much of its time on its feet and which normally even sleeps standing, there is a greater chance of pressure damage to the cartilage owing to the synovial fluid layer being obliterated. In the healthy horse this is obviated by constant regular movements even when asleep. However, it is possible where this movement does not occur so regularly owing to pain caused by a sprain, etc. for the cartilage to be damaged. Nature has evolved an extremely susceptible arthritic vessel in the shape of the horse, and man has added his selfish quota to its genetic burden by putting a sack of potatoes on its back and making it race! It has always been a wonder to me why the horse does not suffer a thousand times more from joint and tendon lameness.

Synovial fluid has the character of a plasma dialysate with a protein in loose combination with hyaluronic acid, which is largely responsible for its viscosity. Pathological synovial fluid may be broadly divided for our purposes into: —

(1) "non-inflammatory," as seen in traumatic synovitis and osteoarthritis, with a high viscosity, low protein and high sugar content. There is a low cell count with perhaps a very few polymorphs.

(2) "inflammatory," as occurs in acute or chronic infections, with a low viscosity, high protein and low sugar content, accompanied by a high cell count with many polymorphs (Ropes & Bauer, 1953). The examination, therefore, of synovial fluid may be of great help when taken in conjunction with other findings (Eggers, 1959). Aspiration is safe provided full aseptic precautions are taken. It is usually necessary before the injection of the corticosteroid into the cavity.

Inflammation of joints is caused commonly by undue stress on the joint concerned. Acute aseptic serous arthritis due to trauma involving one joint is perhaps the commonest condition met with in equine lameness (mono-articular arthritis). The serous inflammation leads to a distension of the joint capsule with synovia and a peri-articular oedema is superimposed. An inherited or acquired mechanical defect or faulty conformation is often a predisposing cause. Sprain of the surrounding ligaments and tendons, resulting sometimes from this mechanical defect in the joint, is the seat of pain and oedema. Pain and lameness are manifested when the joint is used excessively, awkwardly or is subject to trauma. Eventually, osteophytes are formed which will mechanically limit excursion of the joint and thus in certain situations reduce pain and lameness. Obviously prophylactic measures must include reduction as far as possible of factors causing trauma. Any therapeutic agent which lessens the sequelae of inflammation will aid the condition.

The second most common condition is that type of osteoarthritis in which there is a hereditary element present with perhaps a superimposed dietary factor. In this category of "generalised osteoarthritis" may be included some of the conditions listed in the Horse Breeding Act 1918, *e.g.* navicular disease, spavin, etc. Stress and trauma are often the hair-trigger mechanisms which initiates the syndrome.

Finally, there are the joint conditions caused by infections of known aetiology usually secondary to remote focal inflammations of bacterial origin or through breaks in the skin over the joint. We are here mainly concerned only with the first and second types of arthritis.

Bursal enlargements. A true bursa is a closed sac secreting synovial fluid and placed between tendons or interposed at a point of unusual pressure between a tendon (or a muscle) and a bone to allow for the natural play of the parts. Synovial sheaths are included in our definition. Bursae, sometimes known as "false" bursae, also occur between the fascia and underlying structures or between skin and fascia. A bursa may become inflamed as a result of injury to neighbouring tendons; such a condition is one form of "capped hock." It may become enlarged when the skin over it is subjected to undue pressure and acts, therefore, as a water cushion to prevent injury of the parts underneath such as we see in "capped elbow." It is interesting to note that the remnants of a "barbarous veterinary nosology" (Percival, 1852) are particularly evident in conditions affecting the bursae. How weird to the modern mind are such descriptive words as "windgall," "thoroughpin," "bog spavin" or "blood spavin"!

Diagnostic Aids

Nerve block and the use of X-rays are the most important aids in the diagnosis of lameness in the horse. In cases of doubt of the site of lameness efficient nerve blocking can turn this doubt into certainty. Unless one can be absolutely certain of blocking out as required the foot, fetlock, knee or

hock one should seldom make a categorically definite diagnosis of lameness involving any of these sites. X-ray, the other aid to diagnosis which bridges the gap of the traditional "art" and the modern "science," must be used with common sense. A negative radiograph with characteristic lameness can be misleading unless it is kept in mind that the beginning of inflammation of tendons, ligaments and joints is very painful and not necessarily only when a chunk of bone (osteophyte) or a hole (rarefaction) appears and becomes visible on the radiograph. As a maxim it may perhaps be said that when any lesions are visible on the radiograph the condition is irreversible and therapeutic measures can at best only be palliative. There is hope of a cure in the case showing characteristic clinical signs but with a negative X-ray picture. Chandler and Wright (1958) noted that in spite of good clinical response to intra-articular injections of corticosteroids, radiological deterioration often occurred.

Traditional Treatment of Joint and Bursal Conditions

Both in the acute and the chronic type of inflammatory joint disease rest is of paramount importance. Bandaging, poulticing and the application of various kinds of liniments are resorted to in the acute phase, and counter-irritants and ultimately firing in the chronic. A bursal enlargement due to sudden sprain of a tendon or ligament often clears up by treating the sprain. As a rule, if the swelling is due to hard work and there is no lameness, rest alone is sufficient; where inflammation has set in, hot fomentations or poulticing may do the trick. In chronic cases showing exostoses and other severe changes firing is often the only possible resort for alleviation.

The rôle of corticosteroids if used in the early stages, coupled with the conservative treatments, is to reduce swelling and inflammation. This cuts down the period of inactivity which is a major factor in producing chronic lesions and thereby the necessity for firing is reduced.

Counter-irritation, the traditional method of treating lameness caused by chronic inflammation, can now be minimised by *anti-irritation* using corticosteroid therapy (Miller, 1961). In the former method the glowing log is consumed by fanning it into flame, whereas in the latter the log is extinguished by pouring water over it. The anti-inflammatory effects of corticosteroids should not be nullified by rekindling the flame as Miller so succinctly puts it. Very often the "know-all" owner will insist on blistering or firing a part which has just been treated with corticosteroids!

Specific Conditions

Navicular Disease

I have always regarded navicular disease as a wide-spectrum local manifestation of a generalised osteoarthritis in the horse whose predisposing causes were inherited and dietary with concussion as the exciting agent. The condition is conveniently divided into 3 theoretical sub-divisions: —

(i) navicular tendonitis
(ii) navicular bursitis
(iii) navicular osteo-arthritis

(1) *Navicular tendonitis* is the beginning of the disease in the normal run of cases in my opinion. The popular and most commonly accepted theory is that inflammation commences in the navicular bone and extends to other tissues of the foot. This may be true in the rheumatic osteoarthritic form of the disease which arises very insidiously.

Anatomy of the area. From the distal fourth of the metacarpus to the distal end of the second phalanx the deep flexor tendon is enclosed in a synovial sheath. The navicular bursa comes between the tendon and the navicular bone, just where the medial and lateral suspensory navicular ligaments form their suspensory apparatus for the bone. The end part of the tendon at its insertion is a trifle confused being bound down by an annular ligament and passing over the distal navicular ligament which completes the cradle for the navicular bone. Inflammation of this plantar tendo-aponeurosis can obviously be brought about quite easily by stress and trauma and manifests itself in the usual progressive stages either in the acute phase or a chronic sequel.

(2) *Navicular bursitis* is a synovitis of the bursa lying between the navicular bone and the deep flexor tendon and which extends upward to the middle of the second phalanx where it is separated from the joint capsule of the coffin joint by the suspensory navicular ligament. Inflammation of the bursa is a natural sequel to injury or sprain to the surrounding tendons and ligaments.

(3) *Navicular osteo-arthritis*, or "true navicular disease" in my opinion usually arises as a sequel to the other 2 stages as an extension of the inflammatory process; but it may begin spontaneously and insidiously in the body of the navicular bone. In both cases it is a true inflammation of bone and joint capsule with a softening, fibrillation and eventual disintegration of articular cartilage, mostly on the tendinous aspect of the navicular bone. The end result is either: — (1) eburnation of subchondral bone and eventual production of osteophytes and "spurs," or (2) rarefaction of subchondral bone and production of "bony ulcers" or erosions. These sequelae depend on the effects of the inflammation on the blood supply to the bone and, as this may vary, both may be seen together in the same post-mortem specimen in a typical case.

X-ray diagnosis of navicular disease can only reveal stage 3, *i.e.* either the presence of "erosions" or osteophytes on the navicular bone. Claims of a finer distinction must be treated with suspicion because of the difficulty of X-ray geometry technique which varies from radiologist to radiologist. Cases which show characteristic clinical signs but are negative when X-rayed may be considered to be either stage 1 (navicular tendonitis) or stage 2 (navicular bursitis).

Treatment at these stages with intra-articular or peri-articular injections of corticosteroids can be expected to be strongly palliative and probably curative in over 50 per cent. of cases depending on

whether the condition is reversible and providing proper ancillary treatment, especially rest, is given. When, however, the classic clinical signs are accompanied by definite erosions and/or osteophytes on the navicular bone as seen on the radiograph, *i.e.* stage 3 (navicular osteo-arthritis), then the best one can hope for after corticosteroid therapy is a remission of the lameness and a limited prolonging of the working life of the animal. A good farrier is often of more use in some of these cases than a veterinary surgeon.

Between 1956 and 1959 I treated 31 characteristic cases of navicular disease with intra-articular and peri-articular injections of hydrocortisone. Of these 14 were "positive" on X-ray and, after injections, went sound from a few days to a maximum of a year. The remaining 17 cases were "negative" on X-ray and of these 10 went permanently sound after injections as far as is known; the other 7 were sound for periods of up to and over a year. The way I divided these cases were as follows: —

14 navicular osteo-arthritis—(Stage 3).
7 irreversible navicular tendonitis and bursitis predestined to go on to Stage 3.
10 reversible navicular tendonitis and bursitis (Stages 2 & 3) in which the corticosteroids alleviated the inflammatory process and reduced subsequent irreversible osteoarthritic changes (Wilkins, 1957, 1959).

The method of carrying out the injection has been fully described (Wilkins, 1957) and has been used extensively in this country, especially by Bishop (1960) who treated 22 cases of which 16 became serviceable and 5 showed no improvement. Other than for the odd unsuccessful result published in the U.S.A. there appears to be no other literature on the subject.

Other Foot Conditions

Beneficial effects, usually temporary, follow the injections of corticosteroids into peri-articular structures in cases of pedal ostitis, ringbone and sidebone. Laminitis can be cured with systemic corticosteroid therapy.

Sprain of the Fetlock Joint

Local inflammation of the lateral ligaments, flexor tendons or suspensory ligament is characterised by swelling, pain and heat. If permitted to become chronic the fetlock may become knuckled over, or at least upright, and this predisposes to further strains and trauma. Excellent results have been obtained by injecting up to 125 mg. (5 ml.) prednisolone into the joint or infiltrating the ligamentous area with a mixture of local anaesthetic and hydrocortisone. The site of injection is between the metacarpal bone and the suspensory ligament where there is an upward extension of the joint capsule on the posterolateral aspect of the leg just above the joint. Aspiration of synovia may or may not be necessary.

Sesamoiditis: includes the inflammation of the bursa between the sesamoid bones and the perforans tendon which plays over them. The bursa becomes inflamed and fills with synovia. The cartilage covering the sesamoid bones softens, fibrillates and eventually disintegrates forming erosions, whilst the tendon and bone become adherent. The surrounding ligaments become thickened too. The hard swelling is easily differentiated from the soft windgall. Early injection of hydrocortisone, perhaps mixed with local anaesthetic, into the peri-articular structures has been found of great benefit with less likelihood of the sequelae mentioned above.

Windgalls: are bursal enlargements about the fetlocks resulting from concussion, work, and strain of the tendons. They tend to disappear with age and seldom cause lameness. However, when they do so and are enlarged and inflamed, aspiration of synovia and subsequent injection of hydrocortisone into the swelling can prove helpful. Point firing may have to be resorted to to get rid of the blemish entirely but this requirement is very rare.

Sore shins: were treated by Temple (1960) by the injection of 10 mg. (10 ml.) of fluoroprednisolone subcutaneously over the affected area and had good to excellent responses when horses were subsequently taken out of training for 2 weeks. Traditional treatment of rest and hot/cold applications is often all that will be necessary. Proctor (1955) used 1 : 10 solution of hydrocortisone injected over the are.

Sprain of the Flexor Tendons

In recent cases pain and swelling are shown at the back of the leg and there is marked lameness. Gratifying results are obtained usually if 3 to 5 ml. (75 mg. to 125 mg.) hydrocortisone are injected as soon as possible into the lateral and medial aspects of the swollen tendons after, if possible, aspirating some synovia. The leg should subsequently be tightly bandaged with or without a kaolin poultice. Rest, of course, is of paramount importance in every case. In this way enlarged tendons, which are a sign of chronic sprain, can often be avoided together with the traditional counter-irritation. However, where this does occur blistering and firing may be the only answer.

Exacerbations of chronic sprains respond less satisfactorily to hydrocortisone injections.

Synovitis and Arthritis of the Knee Joint

Very often this condition is confined to the structures surrounding the joint when a true "capped knee" similar to "capped elbow" is recognised. An acute or chronic inflammation of the joint capsule is more rightly called carpitis. The acute form is not uncommon in racehorses in training, whilst the chronic type often with well-formed exostoses is more frequently seen in hard-worked hunters.

Early injection of hydrocortisone in the acute case invariably gives marked relief and often prevents the formation of an inflammation-prone "big knee."

The technique involved in injecting the antibiotic-hyrocortisone mixture into the bursa or joint is as follows: —

(i) preparation of knee swelling by clipping, cleansing and application of surgical spirit.

(ii) adequate restraint with a twitch and/or use of a local anaesthetic and/or a tranquillising drug.

(iii) (a) *capped knee*: needle is quickly inserted through skin, subcutaneous tissue and into the

bursal cavity at the most dependent part of the swelling with the leg firmly on the ground.
(b) *Carpitis swelling*: leg is picked up and flexed. This enlarges the space between the small carpal bones. The needle is gently inserted through skin, subcutaneous tissue, joint capsule and synovial membrane.

(iv) synovial fluid is withdrawn or allowed to drain.
(v) syringe is detached leaving needle *in situ*.
(vi) a second syringe containing 5 ml. prednisolone-antibiotic is attached and this is injected into the bursa or joint.
(vii) after withdrawal of needle a sterile dressing is applied and the part bandaged.

Sprain of the Hock Joint. "Sprung Hock."

There is trauma, usually over-extension, of the hock joint as may occur in jumping or slipping. A painful swelling develops which often becomes permanent accompanied by a protracted intermittent lameness. The early injection of a mixture of a local anaesthetic and hydrocortisone into the stretched and painful ligaments will reduce the chances of the condition becoming chronic.

Bog spavin is a distension of the true hock joint and is usually caused by trauma or sprain. When the whole of the structures of the joint have become inflamed, *i.e.*, sprung hock, bog spavin is often a sequel. When inflammation is present lameness is a symptom. Typically 3 fluctuating swellings are seen:

(a) the largest, on the anterio-medial aspect of the hock.
(b) a smaller one on the antero-lateral aspect and,
(c) a smaller one on the postero-lateral aspect.

Marked relief is usually produced following corticosteroid therapy. After suitable restraint or sedation the most prominent part of the swelling is cleansed with a suitable antiseptic. As much synovial fluid is aspirated as possible and 125 ml. (5 ml.) hydrocortisone-antibiotic is introduced through the needle which was left in place after draining away of the synovia. The joint is flexed a number of times after the injection to disperse the hydrocortisone and a suitable sterile dressing is applied and the part bandaged.

A second treatment may be necessary in 14 to 21 days. Light graduated exercise will be the regimen for 4 to 5 weeks from the first injection.

Spavin is a true osteo-arthritis of the hock joint. Early therapy with corticosteroids when the damage to bone and cartilage has not gone too far may avert the chronic incurable stages. It is a maxim that where deleterious irreversible changes have occurred in a joint nothing more than a transient relief can be expected from intra-articular injections of hydrocortisone.

Curb is a sprain of one of the ligaments at the back of the hock. Lameness occurs only when the condition is developing or when it appears in young horses. Early infiltration of the swollen area with a mixture of a local anaesthetic and hydrocortisone is of benefit. Proctor (1955) has used a 1:10 solution of hydrocortisone with success.

Thoroughpin is a bursal enlargement at the upper back part of the hock and the lower side part of the thigh. There are two kinds: (a) the true thoroughpin consists of a swelling of the tarsal sheath and is quite independent of the hock joint, appearing as 2 swellings one on each side above the hock, (b) the other form is an extreme stage of "bog spavin," *i.e.* a distension of the true hock joint, when the excess synovial fluid not having room in front of the joint, forms a third small swelling on the inner side of the hock at the back (seat of curb).

A thoroughpin swelling may become very large. Often it is possible to aspirate 100 ml. or more of synovial fluid, and if this is followed by an injection of 5 ml. (125 mg.) of hydrocortisone the condition frequently shows marked improvement.

Capped hock is a bursal enlargement showing as a swelling over the point of the hock. It is fluid at first but ultimately becomes a fibrous swelling. It is found more commonly in well-bred horses than in the coarser types. The condition is looked on with suspicion as it often occurs in kickers; however, it seldom causes lameness.

If there is inflammation in the part, and in recent cases, aspiration of synovia and injection of 5 ml. (125 mg.) prednisolone will often prevent a chronic sequel. Conventional treatment of hot and cold fomentations alternately followed by a blister in the hope of promoting absorption frequently results in failure. Removing the cause, *e.g.* a pillar post or bale, to prevent recurrence is of course essential.

Capped elbow is a bursal enlargement over the elbow of the same kind as a capped hock. It does not usually cause lameness and mostly occurs in coarse-bred horses. In early cases aspiration of synovia and the subsequent injection of 5 ml. (125 mg.) prednisolone often prevents a fibrous swelling from arising so long as the cause is removed. This is achieved by shortening the shoes in front, doing without calkins or putting tips on.

Stifle Lameness caused by Bursitis or Gonitis

Very few instances of the use of intra-articular or peri-articular injections of corticosteroids in these conditions have been recorded. Systemic therapy by intramuscular injections is more usual and has been attended with success (Wheat, 1955; Quinlan, 1959).

Coxitis

The great difficulty of locating the coxo-femoral joint capsule has resulted in the preference of systemic therapy with long-acting corticosteroids in the treatment of this condition. Hayes (1954) apparently had a few heroic successes.

Systemic Therapy with corticosteroids is of value in laminitis and vague lameness affecting the shoulder, elbow joint, hip or stifle. In laminitis energetic and prompt treatment using purgatives, febrifuges, antihistamines and so on are essential to secure relief as quickly as possible to prevent permanent deformity of the foot. Intravenous and intramuscular injections of hydrocortisone have been used with success (Riley, 1956; Lawson, 1954; Asheim *et al;* 1959; Miller, 1961). Mild cases of laminitis, often

diagnosed as bruised sole or sore feet, often respond to this form of therapy.

I have used 10 ml. of prednisolone (250 mg.) given intramuscularly in vague lameness high up in shoulder, hip or stifle and found it useful. Temple (1960) had success in these high lameness cases by injecting 10 mg. (10 ml.) fluoroprednisolone intramuscularly.

Lymphangitis has been cured by Vigue (1960) using prednisolone trimethylacetate in doses of 250 to 500 mg. intramuscularly.

Epilogue

Every author of a scientific or pseudo-scientific paper suffers from a mentally arthritic procrastinating disease. According to Starkey (1960) even Harvey (1628), the father of medicine, was a victim. In his historical disquisition on the circulation he concludes his remarks on the miscible properties of fire (in which he was obviously out of his depth) as follows: "These considerations, however, properly belong to the section of Physiology, when it will be our business to speak then more at large." Of course he never manages to get round to it. *Further research is always necessary.* It will have to be discussed in yet another paper. But not by me. Let others grasp the torch—Snooks or preferably Snooks *et al.* I have done my stint, Sid.

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The Speakers' Introduction

The Chairman, Mr. H. Bell, called on Mr. C. J. Frank to introduce the paper by Mr. Gray.

Mr. C. J. Frank apologised for the absence of Mr. Gray; however, as Mr. Gray and himself had collaborated to a considerable extent on the paper, he was prepared to be shot at.

It might be argued that the whole outlook of the paper was a little pessimistic. Most practitioners would tend to err on the side of pessimism. It was always nice to be able to save one's patient and to say to the owner that it was not as bad as one had thought. Experience in practice of chronic foot troubles was not very good. A very long time was required in order to get anything like a satisfactory cure—probably something like a year or 18 months, and the foot tended to accommodate itself. In some cases, one got a regeneration of bone in navicular which possibly gave an apparent cure, and it was found that by grooving the foot, the size of the foot was definitely enlarged over a longish time and that, if the disease condition did not get bigger, would give a cure.

One had to be very careful about prognosis. Possibly, a good maxim if one wanted to give a really bad prognosis was to know that one could follow it with a bullet.

Every day he used to see a horse going out which was being put now to its fourth season's hunting, and it was completely sound. There was a typical navicular X-ray. It was incredibly lame. He was surprised, 18 months later, to see a man out hunting on it, going a lot better than the horse he himself was riding, which showed that prognosis was extremely difficult in such cases. One had to be very cautious about it.

He was interested to see that, the papers having been written completely independently, two of the three had touched on the question of navicular disease, which was something about which not a great deal was known.

He hoped that some of the remarks in the paper would lead to an interesting discussion, and he would try to deal with any awkward questions.

Mr. J. S. M. Cosgrove, introducing his paper, said that he appreciated the honour of being asked to address the Congress. As he was following Mr. Frank he would be candid and explicit about that and say he was unable to discuss or say anything about the paper because the conditions described did not exist in Ireland. There, it was thought despicable and inhumane that horses so affected with pedal ostitis and navicular should hunt.

He would not attempt to diagnose navicular disease with X-ray because he had been caught out more often than Mr. Frank. There were in the Exhibition some beautiful X-rays of navicular disease, showing true lesions, but he thought those had been dissected out of a hoof and put on an X-ray screen to give that excellent picture; he had never seen that on his X-ray machine.

Colonel Wilkins had done a wonderful job in reviewing all the literature. He had been humble about his own achievements but they had been quite tremendous. Working as he had with his military horses, which were subject to a lot of strain, stress and concussion, he had kept them in serviceable condition longer than those in practice could.

Colonel J. H. Wilkins, introducing his paper, thanked Mr.

Cosgrove for his kind remarks, which he did not really deserve.

He would start by assuming that no one other than the panel had read the paper. Some members of the audience would read the summary while he was talking and the rest would sit and think of more important things.

What he had tried to get over was that a lot of work had been done on the clinical use of corticosteroids in the treatment of lameness of the horse, that it appeared to work, and was easy to administer and safe to use.

He had listed in the paper the findings of various workers and had added some highly controversial items with regard to navicular disease. He was not prepared to fight a duel on any of those items but would welcome some verbal fisticuffs.

He had proved to his own satisfaction that corticosteroid therapy worked in selected cases of equine lameness. The happiest results occurred where the lameness was due to traumatic causes and where good supportive treatment was given.

He would show some slides to remind his audience of one or two items ; they had no other merit at all.

(The slides were then projected on to the screen to show normal and abnormal conditions of joints and bursae, including sites of injection.)

In complicated joints such as the knee and hock, he always assumed that injection into any part of the joint capsule would result in the complete diffusion of the product to all parts. Ease of access was the criterion and only one site needed to be considered and remembered.

Perhaps the major role of corticosteroids was to prevent an acute case of lameness from deteriorating into a chronic sequel by cutting down the dangerous period of actual inactivity which could be, it was contended, a major factor in producing chronic lesions. Perhaps the key word in steroid therapy was " Early." Unless applied in the initial stages of inflammation of bursal enlargements and joints, the use of the products might in fact delay the inevitable surgery, or firing.

Certain other conditions which caused lameness in horses and which had not been mentioned in the paper had to be kept in mind.

Wounds : the use of steroid ointments applied under a bandage to prevent the occurrence of exuberant granulations and the subsequent scar tissue had been well reported on by Miller in 1961.

Lymphangitis : if caught early, the persistent swelling (" big leg ") was often aborted if corticosteroids were used.

Myositis and *Fibrositis :* most workers reported an invariably beneficial result after steroid therapy.

In chronic cases : the prognosis had always to be very guarded in old-standing cases or in exacerbations of chronic lesions. The use of corticosteroids must be considered merely as a palliative, with occasional happy results in reversible conditions.

The technique of injection is simple : the preparation of the site was to clip the hair, wash with soap and water, rub with ether, paint with tincture of iodine, and allow to dry. In the case of bursal enlargement, after aspiration of as much of the synovial fluid as possible, usually from the most dependent part of the swelling, 5 ml. of the corticosteroid-antibiotic was injected.

In the case of joints, it was very essential, before proceeding, to re-familiarise oneself with the anatomy of the area by referring to a reliable text-book or by getting hold of a cadaver and trying it out. In general 5 ml. of the product was injected per dose.

As far as *after treatment* was concerned, rest was of paramount importance. Supporting bandages would be necessary and half-hour walking exercise morning and evening had to be insisted on for a little bit ; then the exercise might be gradually increased. No case should be put back to normal work for at least four to eight weeks after the last injection ; the longer the rest period, the more chance of a beneficial result.

He thanked Messrs. Glaxo and Pfizer for their generous supplies of corticosteroids in the past, and for their help in sending him reprints of recent reports. The slides were rushed through for him by Mr. Lucas, the Head Technician at the M.R.C. Radiobiological Research Unit at Harwell.

The Opener

Dr. A. C. Fraser said he felt that the subjects for the symposium had been chosen rather at random. They had no one to blame but themselves since those veterinary surgeons who were interested in horses in general practice and in other ways had no proper organisation. Perhaps one day some of them would find the time and enthusiasm to found yet another branch of the B.V.A.—The Society of Equine Practitioners—one of whose tasks might be to ensure that there was not the rather widespread field of equine subjects to discuss on such an occasion. The 3 papers just reached common ground in the problem of lameness, but their only true relationship was that they all dealt with the horse ; he did not think the chairman would find that the present company in their discussion would veer far from horses, however far away they veered from the precise subjects of the paper.

He had been very pleased to receive Mr. Cosgrove's paper and to note the re-marriage of field observation and laboratory work. In his young days, every veterinary surgeon had his microscope and stains and did his bacteriologica lbest. Since then, advance in knowledge had forced specialisation upon them and the tendency had been for the veterinary surgeon in the field and the veterinary surgeon in the laboratory to talk different languages. The Riverside Clinic had its own laboratory, and field observation and laboratory work were going on hand in hand, which was a most satisfactory and desirable step. There was a tendency for that to occur in other large practices and he thought it was a very good indication of an advance in the right direction.

Cosgrove and his co-workers on the subject of *Brucella abortus* had not really broken new ground, though they had widened the area of cultivation ; and it was most interesting to have attention drawn to the much wider effects of *Brucella abortus* infection that occurred in horses than many had realised. He liked the modest claims of the paper. Ten per cent. of positives out of a large number of selected cases was not a very high percentage ; he believed that in areas where there were fewer cattle mixed with horses or where the cattle were less affected with brucellosis, the percentage of *Brucella*-positive horses might be a good deal less. Nevertheless, it was a piece of information which should be valued in practice as one more explanation for mysterious lameness. Gosgrove's advice that S.19 was a powerful weapon and could either refute their suspicions or diagnose and treat their case—all with one prick of the needle—must be appreciated. He could confirm that the positive cases reacted to S.19 in no uncertain manner.

Gray's paper had the unfortunate title of " Some Clinical Observations," not, he thought, the fault of Gray or his co-operator, Frank. He believed that the title chosen was " The Footy Horse," which he considered to be a very good title. It gave an exact limit to the paper but it had not been considered suitable for a Congress paper.

Gray's choice of subject had been very bold. It was Shuttleworth, during the Isle of Man Congress, who had made the remark that to be of real value someone should write a paper on lameness below the pastern joint ; that was what Gray had chosen to do. Not only had he limited himself to that ; he had left out all those conditions below the fetlock joint that could be expected to be cured, and had left the very difficult subject of the ones that veterinary surgeons considered themselves lucky to be able to do anything about. He could not, therefore, have chosen a more difficult group of clinical conditions—navicular disease, pedal ostitis and sidebones—on which to write a paper. He had been very brief in his treatments and he thought it had simply been forced upon him to be brief because there was not very much one could do.

Cortisone, which it was hoped when it was first introduced would achieve remarkable effects, had suffered a reverse swing of the pendulum and one got the impression that it was not nearly as valuable as had been hoped. Both those views were wrong. Cortisone had come to stay. It was remarkably valuable as a routine in a great many cases, as most of those in practice would agree, and it had great value in the group of troubles that Gray had written about, navicular disease, pedal ostitis and sidebones—in some cases, although which cases was not known. That view was confirmed by the opening remarks.

He agreed with Frank when he said that perhaps the comments in the paper were a bit pessimistic about prognosis. He remembered having bought a Thoroughbred mare when he was a student for £12. It turned out to have navicular disease. He had hunted her for 2 seasons and sold her, just as good—or bad—as when he bought her, 2 years later for £7 ; two seasons hunting for £5 and a lot of interesting experience with navicular disease thrown in.

He thought that, regarding the treatment of the cases, enough emphasis had not been put on the question of the farrier. One of the most important items in the care and attention of those cases was that the shoe should be kept in good order. No one really knew of any particular surgical show which would do any good ; what one wanted was good shoeing and very good preparation of the feet and regular attention.

Colonel Wilkins's paper could truly be described as a *tour de force*, a work of strength and skill, by anyone who cared to read through the paper, from the humorous prologue to the amusing epilogue.

He had found Colonel Wilkins's paper to be a most infuriating mixture of solid information and the gay abandonment of one recently freed from grave responsibilities. But he finally boiled down in his mind the 3 items which, as it were, irritated him. One was evaluation of rest in the treatment of lameness. He himself did not think that rest was of very much value in lameness in human beings or in animals, and that was confirmed by modern surgical and medical practice. The effluxion of time was a different matter altogether. The passage of time did very often effect cures, for which veterinary surgeons were liable to send in large bills. That was all right : he thought that it was not the rest that did it, it was the time. He was sure that plenty of time, controlled exercise and not rest, was important. Olver wrote an article some years ago on the subject of the effect of rest on lame horses, and quoting from well over 100 cases that he had in one of his military stations, of horses suffering from chronic lameness, which had been turned out and had the benefit of rest, he said he then fired most of them and the great majority went back to work.

Another minor point was the reference on several occasions to vague high lameness ; he wished to take the opportunity of calling the profession's attention to the value of faradism in the precise definition of the site of lameness in what had been, to so many for so long, vague high lameness. A lot of vague high lameness could be precisely defined and treatment applied locally rather than treatment given in general terms.

His third point of irritation was that, throughout the paper, he did not think enough care had been taken to differentiate between cases reported in the use of cortisone on horses which were actually lame and on those which merely required cosmetic treatment. The reduction of simple swellings in horses with corticosteroids was well established and very often successful, sometimes only temporarily successful, but that success should not be used to imply high percentages of cures in horses which were suffering from conditions which rendered them lame.

He wished to conclude on a point which had already been mentioned by Colonel Wilkins, that corticosteroids had to be used early. Corticosteroids were the stitch in time, and until veterinary surgeons realised that and got it over to their clients, they would still be presented with chronic cases which they might have cured with the use of corticosteroids if they had got there early enough. The general public was really very co-operative in that way, and with the increased value of horses, were very anxious to have them treated as early as possible. With the facilities now available for early diagnosis there should be a better chance of clearing up more cases with that very valuable product.

He looked forward to the general discussion and to the replies by the speakers.

The General Discussion

Mr. C. J. Frank said that, in his earlier remarks, he had not mentioned corticosteroids. He had left all that to Colonel Wilkins, but he wished to say a word about his experience with them. One rather dangerous side of it was jokingly mentioned by Mr. Cosgrove, who cured his horses temporarily with corticosteroids and then shipped them to England, leaving them to be treated here. That was encountered in the racing stables, where one got a horse with carpitis or enlarged fetlock joint from sprain. In the early days, when cortisone first started to be used, it would be injected into a horse with a badly inflamed knee, which would become sound in 2 or 3 days, and it would be absolutely sound. The trainer would be delighted and promptly pop it into a Seller, which it would win. It would then go to another stable only to become as lame as it was before. Probably, these days, that would be considered bad practice. One had to be careful that one was not laying oneself open to a rather shady deal, enabling someone to cure a lame horse temporarily, then passing it on to someone else for a large sum of money. That would be done unintentionally, but it had to be watched. It had to be remembered with cortisones that rest was a vital thing in the case of an inflamed joint. Where they had gone wrong was that they had treated such cases with cortisone, the horses became sound and everyone was delighted, and the horse was then taken on to rock-hard ground and galloped. After a fortnight, it returned slightly worse and another shot of cortisone was pushed in. The same thing was repeated ; the horse got better. To his mind, the condition deteriorated ; if one had never used cortisone in the first place and shut the horse up in a box, possibly with some counter-irritation to immobilise the horse, one got a repair that way. It seemed to him that it was nature's way, if there was damage to a joint or ligament ; nature produced an effusion of fluid to enable the inflammatory process to proceed. The question of what the object in life of pain was, was rather a deep one, but the object, possibly, in a horse having a very painful joint was to immobilise it. He could not use it. That might be what nature wanted. One felt that the Almighty if He wanted a horse to go on working a damaged joint, would not have made it so painful. If the pain was removed, the damaged ligament was not being cured straightaway, and to go on in the false hope that the horse would be cured would make matters worse. To use cortisone haphazardly, without remembering that, was bad practice.

Mr. P. Y. Stead said that some years ago, a panel of the discussion was involved in a certain amount of backchat on the subject of barium sulphate and electric light bulbs. Had that practice now fallen into disrepute ? He had not heard of it lately.

None of the speakers had mentioned the use of Elastoplast. Very good results had been achieved in certain cases of sprain by putting on rather a thick and rather tight Elastoplast bandage.

Could the speakers give a little information on the exact technique of injecting the joints ? He had not used cortisone intra-articularly at all and wondered what the exact technique was ; had one to use a needle with a very blunt point—not an acute needle ? Did one actually strike a bone in the joint or was it essential to find an area where one could pass between two bones : That was a point which had engaged his attention.

What restraint was necessary ? Was local anaesthesia essential in all cases, or no cases ?

Mr. D. G. Earnshaw (Dublin) thanked the speakers for bringing up papers of such interest. Horse practice, to him, was always simply riddled with a great deal of conservatism and tradition not only in these islands but elsewhere. It was refreshing to have something really up to the minute brought to general notice. However, he did not think that some of the older forms of therapy should be neglected, in particular the condition of big knee, which one found not uncommonly in horses and jumpers. He was not altogether sure what Colonel Wilkins meant by the clinical syndrome " big knee " referred to in the paper. One case he was thinking of had an enlarged knee probably as a result of some traumatic injury, perhaps hitting the bars going over : in fact, it was a false bursa. He had tried treating such cases which were usually established some months before he got them. They had already been subjected to a variety of counter-irritations by the owner, and he had tried treating them first with hydrocortisone injections, aspirating the fluid, probably of the order of 4 to 6 oz., and that was analysed. Hydrocortisone had been injected after first aspirating the fluid. The technique was slightly different inasmuch as he aspirated from the bottom of the swelling and used a local anaesthetic in depth as well as tranquillising the animal. The injection was made into the upper part of the swelling to allow diffusion by gravity as well as being assisted by the movement of the animal. On top of that, he used an elasto-crepe supporting bandage which limited the movement of the knee. That did not work at all in some cases but he then tried an injection of iodine, using the same technique and the same supporting bandages ; that worked very well. Lameness was not a feature of the condition, it was only a blemish, but could lead to other things unless rectified. It might be of the order of 3 months before complete disappearance allowed the animal to pass as sound.

He asked for greater precision in the use of some terms. In the discussion of navicular lameness, he preferred to use the words palmar or volar, rather than plantar, the condition usually involving the forelimbs.

Most people seemed to label everything as "cortisone" in talking of corticosteroids. There should be a little more precision in that connexion. Exactly the same thing happened in the use of terminology related to antibiotics; some of which had a very different action to others.

Mr. Cosgrove said that his remarks were prompted by what Mr. Frank had said about horses winning a Seller on cortisone. Cortisone fell into the category of doping; it was a matter in which the profession would have to be very careful in future because analgaesic drugs were increasing every day. He would like to hear views on those drugs, particularly corticosteroids. As far as was known, they were undetectable. That might not always remain so; with the chemists working full blast, they were likely to come on something that would provide a test and one might find oneself involved in legal proceedings. It was a very difficult subject and was so in America to-day; there were about 4 States in America allowing the use of cortisone whereas other States would not allow it at all.

He would like to hear the President's views on the use of corticosteroids.

Mr. P. Y. Stead said that it occurred to him that the approach the Association might make could be to try to obtain the addition by the manufacturers to the corticosteroids of a harmless marker that might be detectable. It would have to be done at the source of manufacture. It was a serious problem and concerned the doping not only of horses but greyhounds. Something harmless might be devised as a chemical that would act as a marker.

Mr. Frank said that, as far as he could make out from the Jockey Club, on the question of markers, their view was that if a horse was so crippled that it would need one of the corticosteroids to be able to run, it should not run; there would therefore be no question of putting markers into the thing.

Mr. Stead said that his point was that an unscrupulous owner might obtain it from an unscrupulous chemist.

Mr. Frank said that veterinary surgeons ought to be allowed to use those things. The Jockey Club ought to give veterinary surgeons permission to use them in special cases. It was very difficult to know when one was using things as definite treatment or when it would be called a dope.

Mr. A. J. Wright (Macclesfield) referred to the treatment of brucellosis and asked Mr. Cosgrove whether he had had any success with or been able to obtain any dead vaccines for treatment. Many years ago, in the heavy horse world, a vaccine, now out of production, was used. It was a dead brucella vaccine and had the big advantage that it did not produce the alarming systemic reactions that occurred with other attenuated vaccines. He wondered if there was a dead vaccine on the market, or whether one had been produced and, if so, if it had any success. Certainly, remarkable success had been achieved years ago with dead vaccine. In those days there was no Strain 19 and the live "Ministry" vaccine was used which gave very alarming systemic reactions although, in many cases, producing complete cures.

Mr. Cosgrove replied that he had never used dead vaccines simply because, as far as he knew, there were none on the market: S.19 seemed to have succeeded them. He had mentioned in his paper that one was liable to get abscess formation, particularly if the lesion was in a vital region, and one used a vital region for the site of injection. Injection near the site of infection seemed to produce acid. John Agnew had told him that he had had quite an experience in treating foals with vaccine.

Miss O. Uvarov said that she wished to comment on some of the points with regard to the use of corticosteroids. It appeared that the use of the word "cortisone" was merely a term of convenience and a bad habit. Cortisone was the first substance to be used therapeutically, but had now been largely replaced by other derivatives. In general terminology, the terms "corticosteroid" or "corticoids" were used. Many of these preparations were now available and practising veterinary surgeons using these drugs should know the type of preparation they required for use in different sites.

As far as intra-articular preparations were concerned, did they require an insoluble corticosteroid? Or was a combination of the soluble and one that was less soluble indicated?

In his paper, Colonel Wilkins said that the antiphlogistic effects of corticosteroids were considered to depend on the length of time they were in contact with the damaged tissues so that presumably the less soluble one was the one that was important. Was it not possible that a soluble preparation might stay in the joint for a time, and possibly cause a certain amount of irritation in the joint? She thought perhaps this could be answered if one could possibly do with the horse or dog what, in fact, had been done in the treatment of some diseases of joints in man. Namely, the preparations had been injected into a joint and then the synovial fluid had been withdrawn at regular intervals to assess the disappearance of the steroid injected. Some of the more soluble preparations might be absorbed from the joint, and others might not. In a recent report it had been shown that in man some corticoids were absorbed from the joint, and this had a certain amount of depressing effect on the adrenal secretion. As to the horse, it would be a great help to those working on the laboratory aspects of these preparations to know whether a long-acting corticosteroid was wanted, or a combination of the two substances, or something that would relieve pain as quickly as possible. Someone had said that perhaps it had been unfair to cortisone at the beginning to think that it would act for anything and everything. After all, none of the corticosteroids cured any specific condition. They simply reversed the tissue changes if those were reversible. Sometimes when people said "cortisone is no good for this condition," on X-ray or sometimes even on *post-mortem* examination, irreversible changes were found—which could not possibly be affected by any therapy.

Although cortisone had been of great benefit to many people and animals the necessity of differential diagnosis was indicated.

Now that there were so many drugs available for use in animals there should be more observations recorded so that clinical evaluation would be shared with colleagues.

Regarding the suggestion that a marker should be used with a corticosteroid, Miss Uvarov did not see how this could be evolved. What had the speaker intended to measure?

She regretted that she had to discuss one specific product but one speaker had said that neomycin with hydrocortisone had been withdrawn from the market. That was only a temporary measure, since their medical colleagues did not require this antibiotic with corticosteroids for use in joints in man. In fact, neomycin and hydrocortisone were again available largely because a number of people had protested when that particular preparation was withdrawn.

The use of other antibiotics with corticoids apparently was not so satisfactory; one veterinary surgeon had noted that apparently some horses were sensitive to penicillin in an intra-articular corticosteroid preparation.

She would like guidance from speakers as to what they wanted; could they define the length of time they would like the corticosteroid to stay in the joint, and what was the ideal quantity to be injected into the usual joints treated with such substances?

Mr. M. D. N. Hunt (Newmarket) said that he had read with interest Colonel Wilkins's remarks on tendon treatment with cortisone. In racehorses, injuries to the flexor tendons were probably one of the biggest problems encountered. Theoretically, the use of cortisone in recent injuries to the tendon and tendon sheath should help in reducing inflammation and restricting excessive effusion in the area. Cortisone treatment combined with controlled exercise should aim at preventing the formation of adhesions between the deep and superficial flexor tendons.

Colonel Wilkins suggested an injection of one of the corticosteroids into the tendon as a method of attempting to treat these conditions in the acute phase. First of all, he himself suggested that Colonel Wilkins meant the tendon sheath rather than the tendon, as the injection into the latter was difficult and usually produced fairly rapid response of increased inflammation.

If one could get to a tendon case early—within 24 hours of its occurring and when the inflammatory swelling of the area had not fully developed—one could usually still locate the edges of the tendons and inject cortisone easily between the superficial and deep flexors without penetrating tendon tissue at all. In such cases, it would seem to be useful to augment the cortisone treatment with cold applications—in the form of frozen bandages—to the leg. One sometimes saw in these cases a very considerable improvement within a few days. It was very evident that a large percentage of the damage had been to the tendon sheath and that the tendon itself appeared to be involved far less than had originally been supposed. The response from

the owner would be that the horse had not " broken down " after all and would have been all right anyway.

It was a mistake, however, to consider that the use of corticosteroids was a magic short cut to the efficient repair of tenosynovitis. Considerable time, together with light graduated exercise was probably necessary before fast work was undertaken, if many disappointments were to be avoided. The trouble was that, so often, one was requested by some more modern thinking owner who did not like firing, to treat a horse's tendon with cortisone some two to three weeks after it had " broken down." At that stage strong adhesions had formed between the tendons and the introduction of cortisone into that area was then absolutely useless.

Mr. R. W. Hartley (Petersfield) asked what was known about the aetiology of the inflammation in the horse's leg ? Could the speakers help with any recent research, if any, on that subject. The horse's leg seemed to be prone to two sorts of inflammation, useful and useless, and, as Mr. Frank said, to interfere with nature by getting rid of effusions that were there for a purpose was a bad thing. On the other hand, there were conditions such as navicular, sidebones, etc., which seemed to serve no purpose. Perhaps the inflammatory reactions in the tendon about which they had heard were of that " useless " nature.

Major H. W. Bishop (R.A.V.C.) wished to comment on the vexed question of rest and time. It occurred to him—and he was very pleased that Professor Trueta at the Plenary Session had given him more confidence for putting the view forward—that when one used cortisone in treatment of joints, one must not immobilise the joint. It was fundamental to any cortisone treatment that the joint was allowed to continue in slight movement. Everyone knew the value of brine treatment in man which, basically, was the removal of weight off a joint and allowing some form of movement. Therefore he felt that with cortisone, particularly into the navicular joint or navicular bursa or a combination of both (if you were lucky) it was important to strive to take the stress off the joint following treatment. By that, he meant proper treatment of the horse's feet by the farrier, thereby reducing pressure stresses, and, if it was not possible, obtaining relief by different means—arranging that the horse was treated in a suitable box and had its light exercise period off hard flooring. So many stables had no bedding at all and horses stamped around on a hard floor. Surely, navicular disease was trauma anyway ? How could one expect to treat it if one was going to allow minor trauma to continue ? The horse needed to be treated certainly in a peat box, and the best answer must be a good, marshy Irish bog for the period of convalescent rest.

The interesting thing about injection of joints and bursae was the type of needle to use. It was a vexed question and one on which he might battle with Wilkins. It was always his reaction that one was more likely to cut out a section of skin with a needle that was almost at right-angles. He preferred to use a long, sloping pointed needle. It was important also to use a new needle for all articular work. When a needle was sharpened, the edge was never the same and one was likely to get a blocked needle or a section of skin in the needle which was pushed into an articular joint. He could not believe that was a good thing.

Finally, he wished to comment on minor things like windgalls. He had a feeling that these were nature's reaction to protecting the horse's leg, and particularly the horse's foot. He would like to hear the panel's views on the importance of windgalls particularly in the forefoot. He felt that they tended to come up because there was something going on lower in the foot, and whenever he saw a windgall, he said " Be careful : look for some pathology in the foot." He did not suggest that all windgalls were of that nature but some were.

Mr. P. S. Hastie (Buckingham) said he was interested in Mr. Frank's remark that as pain was an Act of God it must serve a useful purpose, namely immobilisation of the injured region. This reminded him of the story of the vicar who employed a gardner for 6 months. Commenting on the improvement, he said, " Isn't it wonderful what the Almighty has done," and the gardener said, " Maybe so, but He did not make a very good job of it before you employed me and He was on His own."

The Almighty, he was sure, had not anticipated modern racehorses, the 3-day event horse, nor the amount of high energy value food which was pumped into those animals. Man had seriously altered the natural position ; it behoved him scientifically to correct the unnatural results with this fact in mind.

Secondly, the amount of diffusion which took place in the tendon and tendon sheath on strain was a pathological condition, in its widest sense, and was far in excess of what happened when the same condition occurred in other animals. The mechanics of the horse not only resulted in this but also allowed the diffusion to remain. Consequently there was a happy medium in that matter of whether a horse should be completely rested or not. He remembered Major Oxspring, O.B.E., F.R.C.V.S., telling him that the best place for such a horse during convalescence was on soft conditions in an area big enough to allow the horse to exercise himself but not large enough for it to gallop. Dare he mention the Irish bogs again ? He hoped that Mr. Roberts, of Newmarket, would add something of his expert knowledge of tendon strain treatment.

He wondered if Mr. Cosgrove had done any work with regard to the iodine content of the pastures in which he had found most of the cases of brucellosis. It was known that in cattle outbreaks of brucellosis and breakdowns in vaccinated herds could be associated with iodine deficiency.

For generations, the profession and allied people had been talking about conformation and about the hard high road, etc., and very little has been done in this country on the dietetics of the brood mare and the young growing foal. Was it not possible that much research into the problem of bone structure in the growing horse as related to mineral/vitamin intake, food energy values, soil analyses and herbage variety was now a *sine qua non* of the problem of lameness ?

Mr. E. James Roberts (Equine Research Station, Newmarket) said that the addition of antibiotics to the corticosteroids was practised commonly in human orthopaedics and had now been abandoned as being unnecessary. In the conditions in which injections were made in the lower part of the horse's leg, it was obligatory that an antibiotic should be incorporated with the corticosteroid because the intrasynovial area was a very avascular one, and the risk of inducing infection with the needle was a real one. It was impossible to sterilise the skin through which the needle was passed in practice conditions. He made a plea that when a corticosteroid was to be injected into any synovial structure, it should be combined with an antibiotic, otherwise one was failing in one's obligation to the client.

He scarcely knew how to put his second point. Veterinary surgeons were given the privilege of introducing one of nature's own factors into the repair process of the animal ; they were given one of the hormones occurring in the chain reactions which went on when damage was repaired in the normal way by an inflammation. Colonel Wilkins's masterpiece outlined the chain reaction of the corticosteroid complex. They had a condition in which they were all groping very much in the dark. They were given the hormone and pushed it in and the horse got remarkably better in a short time. They had actually been privileged to interfere at one point in the chain. The horse got better apparently very much quicker than he would have done in the normal process of repair and there was then imposed a load of stress and overstress by excessively early and violent exercise which caused more acute inflammation ; they thereby antagonised their own therapy. The relief produced by the introduction of a corticosteroid was a privilege they were abusing by allowing a horse to go into excessively hard work too early. After the corticosteroid had been introduced they were damping down Nature's normal reaction which would prevent activity in that joint. He thought it was obligatory, after introduction of a corticosteroid, to insist upon restricted exercise, enough exercise to invoke all the normal repair functions that Professor Trueta was talking about in his address.

The question of time and the question of mobilisation and of immobilisation had to be balanced against the rapid relief of pain following the introduction of this new method of treatment by interfering with Nature's own repair process. It could easily become an abuse of Nature's own repair. The point was difficult to make. Veterinary surgeons were working very much in the dark in this condition and were over-enthusiastic because the results were so spectacular in some cases.

Mr. Cosgrove's contribution with brucellosis was a great advance and undoubtedly explained some of the cases in which the corticosteroid appeared to be a failure.

The Chairman said that during the last 15 years he had not

been concerned so much with treating horses' legs. He had used hydrocortisone on two or three occasions with most disappointing results. Some of his friends, exponents of corticosteroids, had told him he had not chosen his cases properly. He had tried it on 2 cases of bog spavin ; that was in youngsters, for cosmetic purposes, and he did all the things he was told to do ; the treatment did not have the slightest effect. The exponents told him he should not have tried it on bog spavin which was notoriously difficult to cure. He would like to be able to cure something, however, which would not recover spontaneously. The animals eventually got better but he could not attribute the cure to cortisone because they did not recover for at least 6 months after treatment. One was a 2-year-old Arab that had never been handled or out of a field. It afterwards won a first place in a Show, but he would not award a decoration to the judges for their eyesight. (For Mr. Cosgrove's information, at least one if not both cases were bled and gave a negative titre for *Brucella*.)

The first thing that struck him when he read Mr. Cosgrove's paper was the reference to abscess formation in the horse after the injection of *Brucella* vaccine ; he himself had used that a long time ago for enlarged bursae at the withers, even for fistulous withers. There was no doubt that it did good, but the abscess formation at the site of the injections was terrifying. He began to think that it was probably like the failure of the body to accept the second dose as in the early attempts to immunise against tuberculosis, and he wondered whether he should have injected it into the jugular vein. Had anyone ever had the nerve to do that ? He would like Mr. Cosgrove to try it and let them know the result. When he had reported these abscesses to the bacteriologist who had supplied the *Brucella* vaccine—he was a man of some repute, quite old and experienced—he was very indignant and accused him (the speaker) of faulty technique ; but although he shaved and scrubbed, of course, he continued to get abscesses.

With regard to Mr. Cosgrove's remark about navicular bursitis in the horse, if he himself had diagnosed a case of navicular bursitis and vaccinated with *Brucella* vaccine and it had recovered, he would give thanks to the Almighty but would still wonder what the patient had recovered from ! It was only a matter of confidence he supposed.

He had been rather amused not long ago by a rheumatism specialist who had addressed a Rotarian Society and told how cortisone had been hailed as a saviour of mankind when it first arrived but they had got to the stage now when they were trying to find out something that would have the same temporary effect and would not be so costly, and they were working to see how they could get the stomach to tolerate the requisite doses of aspirin. He had been taught that 40 years ago, and if that was all the progress they had made it did not seem to him that they had got very far !

Mr. Frank, in reply, said that the question of barium sulphide was a difficult one. All he could say was that he was still a believer in barium sulphide paste on occasions, for horses with chronic sprained tendons that flared out and became heated and slightly painful. He found barium paste applied to the leg for 10 to 12 minutes and left on, then washed off, did, in some remarkable way, help in those cases. Whether it temporarily dehydrated the tissues, he did not know.

He had not used Elastoplast very much in sprains. His impression was that one was inclined to forget the colossal stresses and strains to which a horse subjected its joints when galloping, particularly a flat-race horse or steeplechaser. He could not believe that Elastoplast could be strong enough to be of any value.

He had never used injection of iodine into big knees. He had tried cortisone and external counter-irritation, and after about 6 months the knee usually looked about the same as when he started.

In racing practice, the long-lasting cortisone was required. He apologised for saying " cortisone " ; he ought to be saying "corticosteroids." The trouble with racing practice was that one got a damaged joint possibly early in the season, and throughout the next 3 or 4 months, although one cured the first sprain, the horse was going to be subjected to exactly the same trauma on each successive occasion. He did not like the idea of perpetually injecting corticosteroids into the joints. If one could have something with a long-lasting effect, if possible, that would be ideal.

Major Bishop had brought up the point about not immobilising the joint and said that the weight should be removed. It was all very well but one could not stop a horse standing on its legs. He wished a way could be devised of turning it upside-down for a time. It was a problem they were up against. When there was damage in a horse's foot or in a joint, the horse continued to take weight on it. As he had tried to explain, with his remark about the possible benefit of pain, it was only when the horse was suffering from fairly extreme pain in the joint that he took no weight on it at all. In chronic cases, the mere fact of a quarter of 12 to 14 cwt. resting on that limb tended to aggravate the condition.

He tended to ignore windgalls. The majority were found in horses that had done a fair bit of work and were 7, 8 or 9 years old. He had not found any increased tendency to find foot troubles associated with windgalls.

With regard to Mr. Hastie's remark on the dietetics of the mare and foal, that was frightfully important and a matter about which veterinary surgeons did not know enough in practice ; but they tried hard to obtain a balanced diet for mares and foals, and added minerals and vitamins in what they hoped were the correct proportions to their diets.

With regard to navicular disease, where he was sure diet had, to an extent, a part to play in any possible bone regeneration, he felt it was of value in treating a navicular case to add bone flour and vitamins D_1 and D_3 to the diet in the hope of getting some regeneration in the damaged bone.

Mr. Cosgrove, in reply, thanked those present for supporting the speakers and for contributing so much to the discussion.

With regard to the remarks of Mr. Hastie and Major Bishop, he was very pleased to know that Irish bogs had suddenly become useful ! They had been a source of annoyance and irritation. Underfoot conditions were very important. A trainer in Ireland always put his horse on to 2 or 3 feet of straw.

Earlier on, Dr. Fraser had made some very pertinent remarks. One very excellent suggestion was that there should be an Equine Practitioners' Association. If they managed to enrol 75 per cent. of those present, they would have a strong Equine Practitioners' Association. There was such an Association in America and there could be liaison and exchange of information. The Americans were going, at the next Congress, to open their Association to world-wide membership. He had been at one or two of their meetings. There was a lot of useful information to be exchanged on both sides, and a lot of work could be done together.

Dr. Fraser had brought in faradism ; he himself was a great devotee of it. Dr. Fraser's faradism was a great contributory treatment in the conditions under discussion. If faradism were used, there was no need to use extreme methods of exercise ; there would be no need to move the horse out of the stable. " A stitch in time " was a wonderful phrase for cortisone. Using a stitch in time associated with faradism, the results would be much better.

The horse was the same as the footballer ; one saw unfortunate footballers carried off the field on a stretcher on Wednesday and back kicking again on Saturday. One could not afford to let the horse rest ; with 2 or 3 weeks in the stable, half a season has been lost. Economics to-day did not permit the resting of horses as in Victorian days. Racehorses had to be back quickly on the track if possible. Delay in resting horses could put them out for the whole season and the value to-day of a classic race could make a difference of perhaps a quarter of a million pounds.

Colonel Wilkins said that as far as Dr. Fraser's irritations were concerned, he was pleased and happy that he had been irritated because it implies that he had been stimulated. That, he understood, was the only reason for the meeting, and if everyone agreed on everything it would be very dull.

" Vague high lameness " was a descriptive term to cover those vague high lamenesses familiar to all of them. Veterinary surgeons should be more specific (and a lot of them could be) but it did cover so many of those puzzling conditions occurring in the shoulder and hip that were difficult to diagnose. He could not go into that any deeper. " Rest " had already been dealt with adequately by one of the speakers and he agreed that the term could not mean the same as with a human patient ; he did not imply that the word " rest " was used in its medical sense. One rested as far as one could and graduated the

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SYMPOSIUM ON TISSUE GRAFTING

The Relevance to Veterinary Surgery of Modern Work on Tissue Grafting and Immunity

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Introduction

THE purpose of this paper is to describe some of the interesting developments that have taken place recently in the related subjects of tissue grafting and immunity. I intend to begin with a brief review of some outstanding features of the work and then to follow on with a discussion of their relevance to veterinary science.

The chief aim of modern research on tissue grafting is to enable tissues to be grafted from one animal to another. If this could be achieved then worn out or damaged tissues could be replaced by "spare parts" from another animal. Unfortunately, except in rare instances, even when problems such as the establishment of adequate blood supply to the transplant are solved, the grafts function only for a short time before they are rejected by the host. Animals will, of course, accept grafts of their own tissue. These grafts, which are known as autografts, are useful in surgery but it frequently happens that the individual requiring the graft has no suitable piece of tissue or organ to spare. It would be very useful to be able to take transplants from other animals, but as mentioned above these grafts are almost always rejected whether they are taken from the same species (homografts) or another species (heterografts).

* Papers presented to the Annual Congress of the British Veterinary Association in Oxford on Friday, September 8th, 1961.

The Homograft Reaction

The homograft reaction is the process by which an animal rejects grafts of foreign tissue. Fundamentally it is an immune response on the part of the host depending on the fact that animal tissues contain a large number of antigens capable of inducing immunity when introduced into another animal.

Much of our knowledge of this subject has been obtained from experiments using highly inbred strains of laboratory animals. These have been built up by means of many generations of brother-sister mating so that genetically the members of each strain are extremely uniform. In this case tissue can be grafted from one animal to another within the strain and it will be accepted as if it were the animal's own tissue (in this special instance the grafts are termed isografts). There are many advantages in using such experimental animals, one of the most important

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A Review of the Therapeutic Use of Corticosteroids in Equine Lameness.—*Concluded.*

exercise. He welcomed Dr. Roberts's succinct remarks which put these matters into perspective.

Mr. Hunt had made some very sensible remarks about the treatment of tendons ; he had meant, of course, injection into the synovial sheath and/or the swelling and not into the tendon itself.

On the question of the technique of injection ; the needles he used were long ones (2 to 3 inches long), No. 19 B.W.G., but quite frankly the size of needles was always a mystery to him. Major Bishop had stressed the point of new needles, which was very important. On the question of going in and touching the bone or not, as far as the navicular was concerned, one usually started pushing the needle down and then one went through the navicular bursa before reaching the joint capsule. If one touched the bone, one withdrew a little bit ; pressure of the synovial fluid sometimes pushed the plunger out. In any case, one always pulled up a little of the synovial fluid to make quite sure one was either in the joint capsule or the bursa. He had always injected 5 c.c. (125 mg.) of the stuff. It had to be remembered that the corticosteroids only suppressed inflammation. The dosage had to be adequate and had to be repeated if necessary.

Mr. Earnshaw's technique seemed to be admirable and it was just bad luck that the corticosteroids did not work and the iodine did. It might perhaps have been a little too late and the process had gone to a fairly chronic stage as far as the navicular was concerned. However, he advised him not to give up hope.

On the question of antibiotics : that had been answered by Miss Uvarov adequately.

Mr. Hartley's question was really something which was very difficult to answer, as to the difference in inflammation in a horse compared with any other animal. The background of the whole business was the question of concussion and Mr. Hastie had put the matter into perspective. He had tried in the paper to mention that the horse was under a great arthritic stress with its peculiar tendons and with the concussion they were forced to bear. It had to be expected that there was a different kind of approach to the inflammatory process in the horse as compared with other animals, and ordinary text-book definitions of inflammation had to be read with this in mind.

The Chairman had made some very sensible and far-reaching remarks. He thanked him for the very admirable way in which he had presided, and he agreed with him wholeheartedly that credit must always be given to the Almighty ; corticosteroids were merely man-made tools to help the force of Nature.

The Chairman said that those members present would now rush out to look for the lame horses ! Everyone would wish him to accord a very hearty vote of thanks to the 3 stalwart gentlemen for their instructive papers. They should not forget Dr. Fraser who had opened the discussion. He was sure there would be a lot of discussion when members left the meeting, possibly in the Exhibition, and possibly many who had been silent at the meeting would open up over a stoup of ale. That was where a lot was learnt at a Congress.

being that the difference between any two strains is fixed and the homograft reaction to tissues transferred from one strain to the other is of a known standard severity. In addition the number of genes and histocompatibility factors responsible for graft rejection can be determined for each strain (Barnes & Krohn, 1957).

A description of a typical experiment using inbred animals will illustrate the mechanism of the homograft reaction. Let us assume that skin is grafted from a strain C57 Black mouse to a CBA mouse. During the first few days the graft is vascularised and treated as if it were a graft of the animal's own skin. Soon, however, vascular degeneration occurs, lymphocytes infiltrate and the graft dies and is rejected in about 10 or 12 days. This response is due to the development of immunity to C57 Black mouse tissue in the CBA mouse, and the fact that the host mouse is now immune can be demonstrated in various ways. If second piece of skin is grafted from the C57 Black strain the rejection time is reduced to about 4 days. This phenomenon of accelerated rejection, which is termed the "second set response" is a very useful test for the presence of tissue immunity. Using this method it has been shown that tissue immunity cannot be passively transferred to another animal by the injection of serum from the immune mouse (Billingham & Brent, 1956) even though specific haemolysins and leucocyte agglutinating antibodies may be present (Amos *et al.*, 1954). However Billingham, Brent and Medawar (1954) have shown that passive immunity can be transferred by the injection of living lymph node cells. This suggests that cells and not antibodies are important in the homograft reaction. On the other hand it has been shown that antibodies are effective against some tumour homografts (Gorer, 1942). Although the relative importance of cellular and humoral factors in the homograft reaction is still controversial, recent work has attempted to reconcile the opposing points of view (Amos, 1960).

It is of interest to mention that the familiar tuberculin test can be used, in a modified form, to demonstrate homograft immunity. Instead of tuberculin, specifically immune cells or their extracts are injected (Brent, Brown & Medawar, 1958). Thus it seems that homograft immunity may be classified as a kind of allergy or a hypersensitive reaction of the delayed type, very similar to that demonstrated by the tuberculin test (Brent, Brown & Medawar, 1959).

The Inhibition of the Homograft Reaction

It will be clear from the preceding paragraphs that we must inhibit or avoid the homograft reaction before we can induce animals to accept grafts of foreign tissues. Theoretically this could be done in a number of ways. One method would be to prevent antigens from the graft diffusing into the host, or alternatively the graft could be transplanted to a part of the body where it would be out of reach of the host's defending cells. Another method would be to inhibit the immune response of the host to the tissue we wish to graft. The application of these methods will be illustrated in the following examples:—

(a) *Some tissues and graft sites which are apparently exempt from the homograft reaction.*

Cartilage and bone are peculiar in that they survive quite well as homografts; a fact which finds useful application in clinical surgery. In order to account for this it has been suggested that the cells of these tissues are so embedded in extracellular material that they release very little antigen into the host (Peacock, Weeks & Petty, 1960). Two other tissues which are known to function satisfactorily as homografts are the cornea of the eye, and arteries. These, too, are used in human surgery. However, it has been shown that arterial homografts are gradually replaced by the host tissues (Henly, Crawford, De Bakey & Halpert, 1959). It is not clear whether corneal homografts are also replaced but as the cornea is non-vascular it might not release antigenic material to the host. Still another factor which may be responsible for corneal graft survival may be that the eye is a so-called "privileged" site. This is demonstrated experimentally when homografts transplanted into the anterior chamber of the eye survive unmolested by the host. Another "privileged" site is the brain. Both this and the eye are relatively remote from lymphoid tissue and may thus be especially protected sites for homografts. Experimentally the Algire chamber provides the most extreme example of protection for the homograft. The chamber is a box whose walls are composed of millipore filters which allow the passage of particles smaller than 1 micron diameter but prevent the entry of body cells. A homograft, sealed within the box and implanted into the peritoneal cavity, survives for long periods of time, even in a previously immunised host (Algire, Weaver & Prehn, 1954).

(*b*) *Methods for inducing active tolerance to homografts.*

This work may be said to have begun in a veterinary environment. In 1945, Owen, who had been studying blood group types in dizygotic twin calves, showed that the blood of each twin often contained mixtures of erythrocytes derived from both partners. This phenomenon is the result of vascular anastomosis during foetal development, but as the twins retain mixed blood throughout life they are called blood cell chimaeras or mosaics. Following this discovery Burnet and Fenner (1949) put forward their "self-marker" concept in which they suggested that during embryonic development animals learnt to recognise their own tissues as "self." Other materials met with after birth are then recognised as foreign and "not-self." Therefore, if foreign antigenic material could be introduced into the foetus it would be recognised as "self" in later life and a second experience of it should not elicit an immune response.

Strong support for this theory was given by Anderson, Billingham, Lampkin and Medawar (1951), who showed that dizygotic cattle twins who were blood cell chimaeras accepted skin homografts from each other. These are cases of naturally induced homograft tolerance. Billingham, Brent and

Medawar (1953) then went on to confirm the "self-marker" concept experimentally, inducing tolerance to skin homografts after injecting embryos of mice, rats, rabbits and chickens with cells from the subsequent donor of the skin. The same phenomenon was demonstrated in rats by Woodruff and Simpson (1955) and in chickens by Hasek (1955). The latter author used an ingenious technique for anastomosing the blood circulations between eggs during the incubation period so that they resembled the dizygotic calf twins mentioned above.

The tolerance induced by the above methods is host specific being confined to the donor of the originally injected tissue; but it is not tissue specific, for almost any of the donor's tissues can be used for inducing tolerance or for subsequent successful grafting. An important condition for success is that the first tolerance-inducing injection must be given at a sufficiently early stage of development. New-born mice, for instance, are in a state of transition or "null-period" during which capacity for tolerance induction is poor (Billingham, Brent & Medawar, 1956). Injections given later induce immunity and not tolerance. In rats the period during which tolerance can be induced extends to a fortnight after birth (Woodruff & Simpson, 1955).

It is convenient to mention at this point that tolerance can be induced to antigens other than living cells. Tissue extracts have been prepared which are effective, but the contained antigen is often unstable and special techniques are required to extract it in a potent state. Tolerance can also be induced to bacteria. For example, Buxton (1954) found that the intravenous inoculation of chick embryos with killed cultures of *Salmonella pullorum* induced a state of tolerance. Similarly, Kerr and Robertson (1954) found that antigens prepared from *Trichomonas fetus* and injected into young calves resulted in an apparent state of tolerance because when the animals were challenged with more antigen later in life the antibody response was weak.

Tolerance has also been induced to a variety of protein antigens such as bovine serum albumin and ovalbumin (Smith & Bridges, 1958). These, and other comparatively simple non-living antigens, have proved useful in elucidating some of the fundamental mechanisms involved in the induction of tolerance (Cinader & Pearce, 1958).

The foetal injection method of inducing actively acquired tolerance is unsuitable in clinical surgery as one seldom knows which foetus will eventually require a homograft or which donor will be available. It is possible, however, to induce tolerance in the adult animal by destroying its blood-cell-producing tissues with a lethal dose of X-rays. Mice irradiated in this way normally die in about 10 days but death can be averted if the animal is given an injection of bone marrow cells from another individual either of the same or another species. It is believed that the injected cells repopulate the destroyed bone marrow of the host and thus the animal is now a chimaera, with the bone marrow and blood cells of the donor and the body tissues of the host (Ford, Hamerton, Barnes & Loutit, 1956). By this means mice can be produced whose blood is of rat origin. Such chimaeras accept skin from the original donor of the bone marrow because the immunologically reactive cells in the host are now of the same origin as the skin graft which is thus recognised as "self."

Both methods of inducing tolerance have obvious disadvantages for practical application in surgery and in addition are hazardous in that they are often accompanied by severe symptoms and mortality. This occurs particularly when attempts are made to induce tolerance to tissues of animals of unrelated strains or different species, apparently because the injected cells react immunologically against the host. This is, in a sense, an example of the homograft reaction in reverse; normally the host reacts to reject a homograft but in this case the injected cells react against the host, sometimes with fatal results. The disease syndrome produced has been called "runt disease" or "homologous disease" (Billingham & Brent, 1957; Cock & Simonsen, 1958). However, the mortality rate can be reduced if foetal cells are used instead of adult cells for the tolerance-inducing injection; these cells are not immunologically reactive (Barnes, Ilbery & Loutit, 1958).

(c) *Methods for the non-specific inhibition of the homograft reaction.*

Several methods are available which depress the capacity of the host to react against a homograft. For example, cortisone prolongs the survival of skin homografts in some animals (Billingham, Krohn & Medawar, 1951); 6-mercaptopurine, which is thought to suppress the homograft reaction mechanism (Meeker *et al.*, 1960), modifies the rejection of renal homografts in dogs though unfortunately it has toxic side effects (Calne, 1960); sub-lethal X-irradiation weakens the host's immune response (Dempster, Lennox & Boag, 1950); and a combination of whole body irradiation and adrenocorticoid therapy has been used, with partial success, in human kidney homotransplantation (Merrill *et al.*, 1960). It has also been found that the homograft reaction is inhibited in some diseases such as agammaglobulinaemia, Hodgkin's disease and uraemia; and even in healthy untreated adults foetal tissues will survive for long periods (Toolan, 1958; Payne & Payne, 1961).

The Eventual Solution of the Homograft Problem in Surgery

Although the way is not yet open for the widespread use of homografts in clinical surgery sufficient progress has been made to suggest that the problems involved are not insurmountable. It may be of interest to mention two promising aspects of recent work. One possible solution of the homograft problem is suggested by the phenomenon known as "immunological paralysis." This was described by Felton (1949) who showed that if mice were given injections of small doses of a pneumococcal polysaccharide they produced antibody as expected; but if the doses were large antibody was not produced. This state of immunological paralysis persisted for long periods because subsequent attempts to induce antibody formation with more polysaccharide failed.

To account for this it has been suggested that excess antigen persists in the tissues and neutralises antibody as it is formed. Whatever the mechanism, the condition is similar to a state of tolerance for it is long lasting and specific. If tissue extracts could be prepared containing high concentrations of the antigens responsible for homograft immunity then it is possible that a sufficient quantity injected into an animal might induce immunological paralysis and thus allow the acceptance of tissue homografts from the donor of the extract. Attempts are now being made to prepare purified tissue extracts containing the important tissue antigens which are believed to be amino-acid polysaccharide complexes (Billingham, Brent and Medawar, 1958). There is evidence that large doses of already available tissue extracts may induce tolerance to some kinds of homografts in mice (Billingham & Silvers, 1960).

Other work that may help in the solution of the homograft problem is Chase's discovery (1946) that the allergic response occurring when a simple chemical compound such as picryl chloride is painted on the skin of guinea-pigs can be inhibited if the compound is previously fed to the animal. This situation is similar to a state of tolerance and there is a possibility that the method may be applied later to induce tolerance to tissue homografts.

Relevance to Veterinary Science

The obvious importance of the work on tissue grafting as far as veterinary science is concerned is that it may be possible to use homografts in clinical surgery. Much of the pioneering work for human surgery is carried out using dogs as experimental animals, and with our knowledge of, and concern for, this species we should be in the forefront of such endeavour. With these few remarks I shall leave this subject for general discussion and pass on to less obvious aspects of the relevance of tissue homografts to veterinary science.

It is often forgotten that the placenta is a natural homograft of great importance. Essentially it is an organ in which the cells of the foetus are grafted into those of the mother for at least the length of the gestation period. The explanation for this remarkable phenomenon is unknown. However, pregnancy does sometimes have an immunological impact on the mother. The problem of iso-immunisation of the Rhesus type during human pregnancy is well known and similar conditions have been described in horses (Coombs *et al.*, 1948), and pigs (Buxton & Brooksbank, 1953). It appears that by some means foetal antigens induce the mother to produce antibodies capable of lysing the foetal red blood cells, but the rôle of the placenta in this phenomenon is unknown. In addition it may be that some forms of infertility are due to the mother reacting against the placenta as foreign tissue.

From the opposite point of view it is suggested that the placenta does, in fact, induce tolerance and not immunity. Some recent work has shown that repeated pregnancies in female mice mated to males of the same or another strain, induced a specific form of tolerance to the male tissues (Breyere & Barrett, 1960), and it is also known that human mothers will sometimes tolerate skin homografts from their babies (Peer, 1958).

In recent experiments I have found that animals are relatively tolerant to placental and foetal homografts. If part of the placental membranes of the rat are removed from the uterus at the correct stage of pregnancy and transplanted into the omentum they will grow in a remarkable way (Payne & Payne, 1961). Such experiments may help us to understand how the placenta functions so successfully as a natural homograft and whether the failure of the mechanism could be of importance in infertility.

Another aspect of tissue immunity and the homograft reaction is the recent interesting work on auto-immunity. Burnet and Fenner's original hypothesis was that the animal learnt to recognise its own tissues by experiencing them and their products during foetal life; but there are several cells and tissue products that appear only later in life when the animal is immunologically adult. Thus, in certain circumstances, animals could become immune to some of their own tissues. An example of this is Hashimoto's disease of the human thyroid gland in which the patient becomes immune to his own thyroglobulin. The disease is characterised by chronic thyroiditis and the presence of specific antibodies in the serum (Doniach & Roitt, 1957). Other tissues to which the body may react in this way are the spermatogenic cells of the testis. It is believed that the so-called "collagen diseases" which include rheumatism and similar conditions have an auto-immune pathogenesis. Complement-fixing antibodies have also been found in cases of human chronic hepatitis. These reactions can also be induced experimentally by injections of cells or their extracts combined with Freund's adjuvant (Freund, Lipton & Thompson, 1953). Although there is no evidence to suggest that auto-immunity is important as a cause of disease in domestic animals it presumably is as likely to occur as in the human subject. Certainly conditions like allergic encephalitis can be produced experimentally in sheep and goats (Innes, 1951). Milk is another substance with which the animal comes into contact only after birth, and it has been shown that it is possible to induce sensitivity to milk casein (Lewis, 1934). Has anyone looked for antibodies against milk in the blood serum of cows suffering from chronic mastitis?

The results of the work on tolerance have given rise to new thinking and speculation in subjects superficially unrelated to tissue grafting. For instance, the induction of tolerance to extraneous substances in foetal life might play a part in the epidemiology and pathogenesis of infectious disease. Infected foetuses which survive might be expected to be in a state of tolerance to the organism concerned. In adult life such animals might be symptomless carriers of disease and a source of danger to their fellows. This may be the case in diseases such as Pullorum disease of chickens and swine fever of pigs. On the other hand a condition of tolerance might allow a relatively weak pathogen to multiply

uninhibited by the host and thus cause its death. Johne's disease might be an example of this, for *Mycobacterium johnei* has been isolated from foetal calves which, if they survive, may progress to clinical cases. It is well known that calves must be infected when young for clinical disease to develop and this may be associated with a state of partial tolerance.

Conclusions

This paper has given a very brief account of some recent experiments on tissue grafting and immunity, but probably enough has been said to indicate that there is some hope that we shall be able to use tissue homografts in the veterinary surgery of the future.

The relevance of the work may extend beyond the surgical aspect to other veterinary problems. There is a possibility that auto-immune diseases may exist in domestic animals. It is also suggested that some recent work on tolerance and immunity may find application in studies on infertility and the pathogenesis of infectious disease.

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Skin Grafting in the Treatment of Granulating Wounds of the Horse's Legs

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SUMMARY.—Wounds about the legs of horses often fail to respond to orthodox methods of treatment due to excessive loss of skin and the subsequent persistent formation of exuberant granulation tissue. In such cases treatment by skin grafting might be successful. The type of wound in which this treatment is indicated, and the method of grafting are described. Protocols of 8 cases, 5 of which were successful are given.

Introduction

SKIN grafting as a means of repairing large epithelial defects in the human subject is a well established surgical procedure which has been progressively developed over the years from the simple pinch grafts of Reverdin to the complexities of modern plastic surgery. Progress in these methods in the veterinary field has, however, been extremely limited. It must be admitted that the incidence of

wounds in which skin grafting could usefully be applied is less in domestic animals than in the human subject; nevertheless, the horse, in particular, is a subject in which this method could have extremely useful applications, since this species is particularly prone to wounds about the limbs, which may, due to the failure of conventional methods of treatment, result in the ruination of an otherwise perfectly healthy and possibly extremely valuable animal.

Previous reports (Nilsson, 1944; Woolsey & Schaffer, 1952; Uberreiter, 1956; Amman, 1958) have shown that the treatment of extensive skin wounds in the horse by skin grafting is a practical possibility. In an earlier communication (Neal, 1958) the present writer gave a brief account of 3 cases in which skin grafting was performed, and concluded that the technique has useful applications in general practice. Subsequent experience has tended to confirm this, though with some reservations.

This paper comprises a discussion of the techniques involved, together with an account of their application in 8 clinical cases.

General Considerations

Indications for skin grafting

Skin grafting is indicated in wounds involving a loss of skin so extensive as to preclude the possibility or likelihood of epithelialisation of the denuded area by ingrowth occurring from the border of the wound.

Such a degree of skin loss may be immediate as in the case of gross lacerated wounds, or it may occur as a secondary feature, days or even weeks after the initial injury. Secondary skin loss frequently occurs as a result of gross bacterial infection and consequent necrosis, especially in cases where there has been severe contusion of the skin. It may also follow the ill-advised suturing of a wound which would be better left unsutured. In these cases, the tension of sutures interferes with the blood supply to the edges of the wound, particularly if significant swelling occurs after the sutures have been inserted. Such conditions not infrequently lead to the sloughing of a considerable area of skin. Sutures may also contribute to bacterial necrosis by interfering with drainage. Another cause of secondary skin loss is the formation of a chronic fibrogranuloma. The lesion commonly follows wounding of the horse's leg at a site closely related to a joint or tendon, the constant movement of which causes a continual breakdown in the healing process. As a result exuberant granulation tissue is formed, this progressively heaps up, with fibrosis occurring in its deeper parts, resulting in the formation of granuloma at the site of the original injury. The lesion tends to "mushroom" over the edges of the original lesion forming a recess in which exudate accumulates, causing devitalisation and ultimate necrosis of the underlying skin. Further granulation leads to further mushrooming and consequent progressive skin necrosis. Thus as the granuloma enlarges, so the area of skin loss becomes greater. This type of lesion is well illustrated in Case 8, a high quality mare which sustained a 5-inch tear of the mid-cannon region of the left hind leg. This case received veterinary treatment from the outset, the wound being dressed with sulphonamide and firmly bandaged. Healing progressed satisfactorily for a fortnight when the owner on his own initiative removed the dressing. From this point exuberant granulation tissue formation rapidly developed. Ten weeks later, when the mare was admitted to this hospital for treatment, a spherical granuloma, 10 inches in diameter, had developed involving at its base an area of skin loss measuring some 6 × 5 inches (see Figs. 1, 2, and 3).

FIG. 1.—Case 8. As presented for treatment.

FIG. 2.—Case 8. Seven days after the application of "postage-stamp" grafts. One graft remains, the others having been dislodged by movement.

In the majority of cases secondary skin loss can be avoided by careful and continuous treatment of the wound from the outset. Thus the infection factor can largely be eliminated by the provision of adequate drainage where necessary, by the removal of foreign material and devitalised tissue, the generous application of sulphonamide, and the avoidance of suturing where the nature and site of wound clearly contra-indicate it. Exuberant granulation of limb wounds can largely be controlled by the application of a firm pressure bandage which also serves to protect the wound from further trauma particularly when the animal is recumbent. Bandaging of the wound must be maintained until the wound has completely healed.

FIG. 3—Case 8. Epithelialisation almost complete.

Unfortunately, many owners do not realise the serious potentialities of wounds about the legs, and not infrequently—judging by experience in this hospital—veterinary advice is called only when infection, and/or exuberant granulations are already well established.

Where a leg wound involves skin loss to a degree warranting grafting, it may be found that the position of the lesion makes this impracticable. For grafting to be successful it is essential that the wound shall be at a site which can be firmly bandaged for an indefinite period. In this respect wounds involving the limbs below the hock or knee are in general most suitable. On the other hand wounds involving the tissues covering these joints, or situated above them, are extremely difficult to deal with. In the one instance, the flexion and extension of the joint tend to make effective bandaging almost impossible especially in the case of the hock, and in the other instance the tapering conformation of the limb results in the bandage slipping down the leg. Elastic adhesive bandages may be used in an attempt to overcome these difficulties, but as previously reported (Neal, 1958) prolonged application of these bandages direct to the skin can cause acute dermatitis. The treatment of 3 of the cases under review failed from the above causes. The sites involved were the stifle joint (Case 2), the anterior aspect of the hock joint (Case 6), and the lateral surface of the hock joint (Case 4).

Although the lesions in these cases were not exceptionally large, treatment by skin grafting had to be abandoned because of the impossibility of maintaining adequate pressure bandaging of the grafted area.

Methods of grafting

In general the methods of skin grafting may be classified into 2 categories: pedicle or tube grafts, and free grafts.

Pedicle grafts involve the transference of an area of skin and subcutaneous tissue from the donor site to the wounded area, the blood supply to the graft being maintained by means of a tube or pedicle of skin which is severed when the graft is established. By this means the nutrition of the graft is ensured during the critical first few days. Although successful pedicle grafting in the dog has been described by Cowley and Francis (1958) and Jensen (1959) the technique has not, so far as the writer is aware, been applied to the horse. In this regard it is highly probable that the lack of loose skin about the horse's limbs would make the provision of a pedicle of suitable size a serious if not insuperable difficulty.

In contrast, free skin grafts are entirely dependent for their nutrition on exudate from the recipient site until such time as adequate capillary circulation has been established. Consequently, whether or not the graft will survive during the first critical days will largely depend upon the availability and suitability of the nutrients, the ability of the graft to utilise them, and the absence of such factors as movement, direct trauma or bacterial infection. In the human subject, grafts of various thickness are used ranging from very thin epidermic grafts to whole thickness grafts. In general, epidermic grafts take well, since their cells are virtually bathed in exudate from the donor site, thus enabling them to survive until a circulation is established. However, they have the disadvantage that when healing is complete the skin of the grafted area tends to lack mobility and is rather easily injured; in addition pigmentation tends to occur though this would be of little significance in the horse. Full thickness grafts, on the other hand, are unlikely to survive except under ideal conditions owing to their inability to absorb adequate nutrition during the first critical days. Nevertheless, when successfully used, a stronger more pliable area of skin results.

" Split-thickness " grafts are a compromise between the two. This type usually " takes " well, and when healing is complete the grafted skin is pliable and not unduly susceptible to trauma. Finally pinch grafts, as used in human surgery, consist of small discs of skin, about 0.5 cm. in diameter, of the whole thickness in the centre and tapering off towards the edge. These are firmly implanted on to the area

to be grafted. Pinch grafts which have "taken" form islands of skin in the raw areas, from which epithelium grows outwards coalescing with that from neighbouring grafts and thus eventually covering the raw area. This method of grafting is simple and usually results in a high percentage of "takes" but is now rarely used in the human subject because the skin of both donor and recipient areas assumes an unsightly roughened appearance. This factor is of less significance in the equine subject.

In considering the method which might be applicable to wounds of the horse's leg, it must be borne in mind that it is virtually impossible to immobilise the limb. Thus some degree of movement of the grafted area and the overlying dressing inevitably occurs, particularly in cases in which the tissues overlying a tendon or joint are involved. Such movement seriously endangers the survival of the grafts. It is, therefore, unlikely that whole-thickness grafts which require optimal conditions for survival, would be applicable in clinical cases in the horse. Split-thickness grafts, on the other hand, which "take" much more readily, have been successfully applied by Uberreiter (1956). Pinch grafts, owing to their small size, would appear to be the least susceptible to the damaging effect of movement, and this fact, together with the high percentage of "takes" obtained make it a particularly attractive method for grafting in the horse. Cosmetic effects are of little significance.

In applying a modification of the pinch graft method to the horse, Woosley and Schaffer (1952) found that grafts applied directly to the granulating surface were dislodged due to friction between the bandage and the wound. They therefore buried the grafts in the granulation tissue thus largely eliminating this factor. The grafts used by these authors were split thickness segments of skin, cut into small pieces approximately 2 to 3 mm. in diameter. Seven of the cases described in this paper were dealt with using this method, and one using split thickness grafts. This latter did not "take" and the wound was therefore treated by the modified pinch method.

Technique of Grafting

(a) *Preparation of area to be grafted*

Before grafts can be implanted, it is necessary for the wounded area to be covered with young, healthy granulation tissue. A lacerated wound, therefore, should be dressed with sulphonamide and/or penicillin ointment until such a state of affairs exists. It is essential before attempting to graft the area to ensure that sepsis has been completely overcome. A difficulty in dealing with severe wounds of large areas is that the depth of tissue involved may not be constant throughout. Thus, in one part of the wound granulation tissue may have reached the level of the skin, while in another there may be a repression of half an inch or more. In these, it is desirable to delay grafting until granulation has obliterated the depression. Where the lesion comprises a large fibrogranuloma, this must first be excised to a level of about 5 mm. below the surrounding skin. The lesion should be dressed and bandaged and grafting delayed for about 14 days by which time the granulation tissue will have grown level with the skin.

The suitability of a granulating area for grafting can best be judged visually. Granulations should be pink in colour, have a healthy appearance and bleed easily. There should be little exudate and this should be non-odorous. If there are signs of infection such as pus exudation or pain, then grafting must be delayed until this has been overcome.

(b) *Grafting*

The method has been described in an earlier communication (Neal, 1958) but is briefly included here for the sake of completeness. Skin may be obtained from any convenient site. Since only a small area is required, it is commonly taken from the neck or the region just lateral to the anus. An area about 2 square inches in diameter is shaved, washed, and dressed with spirit. Local anaesthesia is then injected subcutaneously. The anaesthetic used should be as dilute as is practicable in order to avoid toxic effects on the grafts. Skin for the pinch grafts is removed using a large scalpel blade or a razor. The blade is held at an angle of about 45° to the skin and the section cut using a rapid to and fro sawing motion. Ideally the cut should be made through the papillary layer of the corium, so that a few centres of the stratum germinavitum are left to epithelialise the denuded area. Multiple pin-point haemorrhages over the cut surface are an indication that the skin section is of correct thickness. As a rule a piece of skin about 1½ inches square is sufficient for grafting the majority of wounds. The skin is placed into a Petri dish containing normal saline and is cut into grafts measuring 2 to 3 mm. square. Immediately prior to the implantation of the grafts, the area to be treated is thoroughly cleaned of all exudate and cellular debris by the application of warm saline packs. The grafts are picked up one by one with a pair of sharp pointed forceps and pressed obliquely into the granulation tissue to a depth of about 5 mm. The forceps are withdrawn leaving the graft "buried" in the granulation tissue. Grafts are implanted at intervals of approximately 1 cm. in horizontal lines; the lines themselves being a similar distance apart. It is important to commence grafting at the ventral part of the wound, for if this is not done the bleeding which results from the insertion of the grafts tends to obscure the area still to be dealt with. The area is then treated with penicillin ointment and covered with a piece of paraffin gauze. The area is wrapped in an even thickness of cotton wool and a firm pressure bandage is applied. A superimposed layer of adhesive bandage (which does not touch the skin) serves to give further support. The initial dressing is all important as it must remain in position for 5 days. Should it come loose and movement occur, it is highly probable that the majority, if not all, of the grafts will be lost. It is also likely that the raw area will be severely injured.

After grafting of the wound the horse should be tied up short for the first few critical days to re-

strict movement as far as possible. The dressing is renewed after 5 days. On removing it the wound is usually found to be covered with fairly copious, brown exudate. This is gently washed away with warm sterile saline. Fresh dressing and bandaging are then applied. Thereafter the area is similarly treated at weekly intervals until epithelialisation is complete.

Results

In a successful case the majority of the grafts which have "taken" are first seen 14 to 35 days after implantation. They appear as grey "pinched out" areas with a white periphery, about 2 to 3 mm. wide. Some grafts, however, may not appear for a much longer period. The islands of epithelium progressively enlarge, and spread over the granulation tissue until they coalesce. In the meantime, the epithelium grows inwards from the edges of the wound making an important contribution to the healing process. Eventually the whole area is covered by a delicate layer of epithelium. This process is a slow one and in the writer's experience may take from 5 to 32 weeks, depending on the number of grafts which "take" in relation to the area of the wound.

Due to this prolonged healing time, granulation of the raw portions, although in measure controlled by the pressure bandage, slowly continues and consequently there is a tendency for these areas to become raised above the surface of the surrounding skin. As a result, in some cases, the healing processes develop into a "race" between the spread of epithelium and the continuation of granulation. In some cases epithelialisation is complete before granulation becomes excessive, in others granulation is the more rapid process. In the latter the granulating surface commences to overlap the skin edges and when this occurs ingrowth of epithelium from this source ceases. In these, the excess granulation, provided it is not covering too wide an area, should be trimmed off with a scalpel. No anaesthetic is required to do this but for obvious reasons it is advisable to have the animal well restrained. Should the granulation become excessively raised over a wide area it is best to cut it all away to a level below that of the surrounding skin and start afresh. Regrafting into old granulation tissue is not recommended, owing to its poor vascularity, and the consequent unlikelihood of an adequate number of "takes."

In successful cases the epithelium covering the wound is at first delicate and susceptible to trauma, but with time becomes progressively more robust. It is essential that during the early period the epithelium be protected by the application of a stable bandage.

Discussion

Probably the most important factor governing the outcome of skin grafting is whether or not the wound is in such a position that firm and prolonged pressure bandaging can be applied. This was illustrated in Cases 2, 4 and 6, in which treatment by grafting was abandoned because the site of the wounds precluded the maintenance of adequate pressure-bandaging for the prolonged period required.

A disappointing feature in all cases was the small proportion of grafts which survived, ranging as it did from 15 to 20 per cent. (a figure approximately the same as that reported by Woosley and Schaffer). Many of the grafts were lost almost immediately following implantation, being literally washed out by bleeding. No doubt others were squeezed out during the application of the pressure-bandage, and movement of the limb accounted for further loss. Another possibility is that grafts after implantation in the granulation tissue may be enveloped in blood clot, which would tend to prevent the establishment of a capillary circulation before the graft died. These factors are, of course, inseparable from this method of grafting.

Although the survival rate of the grafts was low a sufficient number of "takes" occurred to make a major contribution to the epithelialisation of the granulating area. In addition, ingrowth of epithelium from the periphery contributed to a considerable degree, and in only one case (No. 5) can it be said that success was not dependent in some measure on this factor. Nevertheless, it is unlikely that healing would have been complete in any of the successful cases without recourse to grafting.

The prolonged period of healing is an obvious drawback of this method, occupying as it did in the cases quoted from 5 to 32 weeks. The question arises as to whether the method is applicable in general practice. From the technical point of view it undoubtedly is. The operation requires no special skill or equipment and can quite easily be performed with the horse in the standing position. The only anaesthetic necessary is for the excision of the skin required for the grafts. Their implantation into the granulation tissue is painless and calls for no anaesthesia, although it is advisable in restless subjects to administer a tranquilliser drug to prevent movement while grafting is being performed. The operation is not time consuming and in the average case can be completed in about three-quarters of an hour. Once grafting has been completed, the all important factor is the efficient dressing and bandaging of the wound which must be continued throughout the period of healing. Should the bandage slip off for only one night, the delicacy of the tissues involved is such that even slight trauma will ruin the treatment, and moreover, there is always a danger of gross trauma when the horse is recumbent. It is desirable, in order to keep down costs, that the owner should apply the dressings subsequent to the first one or two himself. It is here the difficulty may arise, for it is the experience of this hospital that few owners have the skill to dress the wounds effectively. Thus, before the owner is entrusted with the routine dressing of a case, the veterinary surgeon must ensure that it will be done effectively.

Although the success in the cases described was limited, it is clear that skin grafting can be of considerable value in the treatment of granulating wounds about the legs of the horse. The method of

grafting described has many disadvantages. It is hoped that this report will stimulate interest in the subject of skin grafting and that as a result improved techniques will be developed which will give more certain and rapid results.

Case Protocols

Case 1. Three-month-old pony colt foal. There was a extensive wound of the right hind cannon. The extensor tendon was severed. Antibacterial dressing and pressure bandages were applied. After one week the wound consisted of a flat plaque of granulation tissue 4 × 2½ inches in size on the anterior aspect of the cannon. Approximately 50 grafts were implanted of which 9 survived. Healing, though complete, was protracted and occupied 20 weeks.

Case 2. Seven-year-old hunter gelding. There was a large fibrogranuloma 4 inches in diameter, situated 6 inches below the right stifle joint. This was removed under general anaesthesia, and the wound allowed to granulate. In order to maintain pressure an adhesive bandage had to be tightly applied. This resulted in a severe purulent dermatitis. Grafting was performed 10 days following the removal of the granuloma. Due to the dermatitis the adhesive bandage was not reapplied. An attempt to maintain pressure using a gauze bandage failed due to the tapering shape of the limb. As a result the attempt at grafting the area had to be abandoned.

Case 3. Yearling Thoroughbred filly. This filly sustained a gross lacerated wound of the left hind cannon, involving considerable skin loss. Approximately 4 inches of the extensor tendon was laid bare, and medially a considerable area of the metatarsus was exposed. Granulation was satisfactory, and after one month the wound which then measured 5 × 3 inches was grafted, about 120 grafts being implanted, 20 of which survived. Two months later, epithelialisation was complete. However, following removal of the pressure bandage, considerable swelling occurred which caused a ½-inch split in the epithelium. This delayed complete healing for a further 8 weeks.

Case 4. Yearling Thoroughbred filly. This filly had sustained a small abrasion on the lateral aspect of the left hock shortly after being born. A small granuloma developed at the site which was treated successively by ligature, caustic, and finally surgically. Each time it recurred. When presented for treatment the lesion was 3 inches in diameter at its base. It was removed under general anaesthesia and a pressure bandage applied. Fourteen days later the granulating area was grafted. It was found that due to constant flexion of the joint, the pressure bandaging was inadequate and, as a result, exuberant granulations developed. Treatment had, therefore, to be abandoned.

Case 5. Hunter gelding. There was a granuloma 3 inches in diameter immediately above the coronary band at the postero-external aspect of the off-fore digit. This was removed under plantar block and 13 days later the granulating wound was grafted, 50 grafts being implanted. Of these 10 survived. Epithelialisation was rapid and was complete 5 weeks after grafting.

Case 6. One-year-old Thoroughbred filly. This filly sustained severe lacerations of the anterior aspect of both hocks. The left hock healed well, but a granuloma gradually developed on the right hock. Six months after the original injury the filly was admitted for treatment. There was a granuloma 2 inches in diameter on the anterior aspect of the right hock. This was removed under general anaesthesia. Sixteen days later the granulating area was implanted with approximately 60 grafts. Owing to the fact that the wound was situated directly over the hock flexure, it was impossible to maintain the necessary pressure over the grafted area. As a result, granulation tissue formation could not be controlled, and the attempt to treat the lesion by grafting failed.

Case 7. Three-month-old Thoroughbred colt foal. There was a freshly inflicted wound measuring 8 × 2½ inches on the lateral aspect of the right cannon. The extensor pedis was partially severed. The wound was dressed and bandaged at regular intervals prior to grafting. After a fortnight the foal tore at the bandage with its teeth and exposed the wound. The granulating area was severely damaged, and grafting as a result was delayed for a further 2 weeks. Grafting was performed a month after the initial injury. The implantation of the grafts appeared to stimulate the ingrowth of epithelium from the periphery of the wound, and by the time the grafts had become established, the width of the raw area was reduced to about 1 inch. Healing was complete 7 weeks after the implantation of the grafts.

Case 8. Six-year-old Thoroughbred mare. This mare sustained a severe lacerated wound of the left hind cannon. The extensor pedis tendon was severed but there was little immediate skin loss. Dressings were applied for 2 weeks after which time the wound was left unbandaged. Ten weeks later the mare was presented for treatment with a granuloma 10 inches in diameter on the anterior aspect of the metatarsus. This was removed under general anaesthesia to a level about ¼ inch below the surrounding skin. After 3 weeks granulation tissue had grown level with the skin. The area measuring 6 × 5 inches was grafted using approximately 30 postage-stamp-size split thickness grafts which were applied to the surface of the granulating area. When the dressing was removed 5 days later, it was apparent that the majority of the grafts had been dislodged by movement. A few were still adherent to the granulating area, but these also became dislodged within the next few days. The granulation tissue by this time had a tough, relatively avascular appearance. Nevertheless, it was decided to attempt regrafting, and about 150 small grafts were implanted into the granulation tissue. Of these only about 12 survived, an insufficient number for so large a wound. Granulation tissue formation continued, and as a result the raw area became elevated about 1 inch above the surrounding skin. It was decided at this stage to start afresh. Excess granulations were again cut away to a level below the surrounding skin. Ten days later the wound was regrafted. Twenty-five grafts survived. Epithelialisation of the wound slowly proceeded and healing was complete 16 weeks after the final grafting operation.

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THE SPEAKERS' INTRODUCTION

The Chairman, Mr. L. G. Anderson, said that the first paper was a more general one on the principle of grafting, dealing particularly with the reactions of the host body, and the second described one practical application.

Dr. J. M. Payne said that his aim was to discuss some of the exciting research work which had been going on in the related subjects of tissue grafting and immunity.

Although animals would normally accept grafts of tissue taken from their own bodies and transplanted to another site, this was of limited use surgically. Grafts from other animals, which were called "homografts," would be of greater value but they were nearly always rejected by a mechanism known as the "homograft reaction." Modern work had shown that the reason for this was an immunological reaction of the host against foreign tissue. Various experimental means were available to avoid this but none were sufficiently developed yet to be of value clinically. The use of homografts in future surgical techniques was not the only relevance of the work to veterinary surgery. There was the possibility that tissue immunity might be important in such problems as infertility. In addition auto-immune diseases, which are known to occur in man might occur in animals, and also the interplay of tolerance and immunity might be important in certain infectious diseases.

Mr. P. A. Neal said that anyone who had been engaged in horse practice would be familiar with the very awkward case of the equine fibrogranuloma. It usually arose as the result of an otherwise fairly simple wound of the horse's limbs, particularly about a joint or tendon. As a rule, owners did not appreciate the potential seriousness of those lesions and as a result they were frequently neglected. Constant movement of the joint tended to break down the granulating tissue and this stimulated the formation of more granulation tissue which became heaped up forming so-called "proud flesh." If it were still neglected, further skin destruction occurred, the formation of granulation tissue progressed and the end result was the classical chronic fibrogranuloma which, in some cases, attained enormous size.

The conventional method of treatment was removal of the granuloma either surgically or by cautery. In many cases those simple methods were successful, but most practitioners would have seen the cases which did not respond to those simple methods, and it was those which were sometimes suitable subjects for skin grafting.

In the medical field skin grafting was an extremely complex matter and very intricate techniques were adopted in plastic surgery in man. The method of grafting which he had described of implanting small pieces of skin in the granulation tissue was a method which the medical profession abandoned many years ago because of the unsightly appearance of the affected region after healing was complete, which had a "crocodile" skin appearance, and also because the new epithelium covering the area was delicate and rather susceptible to trauma.

The factor that made this method particularly applicable to the horse was that the small grafts employed were less susceptible to movement than the larger pieces of skin used in other methods. In the human field if a skin graft were applied over a joint the patient would co-operate in keeping the joint immobile during the period in which the graft was taking; but one could not immobilise a horse's joint since such co-operation would not be forthcoming. On the contrary, horses tended to oppose forcefully any attempt to immobilise a joint. Thus if large areas of skin were used as grafts, the probability was that they would be destroyed by movement. However, small grafts buried in the granulation tissue were less likely to be dislodged by movement. Even so, of the grafts which were implanted by that method only about 20 per cent. survived. The majority were dislodged by movement of the horse.

(Mr. Neal showed a number of slides illustrating a case of fibrogranuloma and its treatment by skin grafting.)

The method obviously was not everything that one would desire. The greatest drawback was the length of time it took for healing. Up to 32 weeks was the time for healing in the case of a mare. The shortest healing time was 5 weeks. Nevertheless, it was unlikely that the wounds would have ever healed had grafting not been performed. It was desirable that some method be found by which fairly large areas of skin could be applied to granulating areas, without their being dislodged by movement. A possible method was to anchor the grafts in position by suturing them to the skin bordering the wound, and possibly also to the granulating area in the case of very large wounds.

What were the applications of the method in practice? Was it something which could only be carried out in a well equipped and staffed hospital? In his view it was not. It could be done in practice. A section of skin about 1 in. square was taken and cut into pieces about 2 mm. square. These were then implanted into the granulation tissue using sharp forceps. The technique, itself, was simple, no expensive equipment was necessary, a general anaesthetic was not needed, and it was not a time consuming operation, the whole procedure occupying only about three-quarters of an hour. The difficulty in practice concerned the subsequent dressings. Dressings must be applied weekly until epithelialisation was complete. It would be rather costly if the practitioner attended all the dressings himself, and it was therefore desirable that this should be done by the owner. However, the owner's idea of a pressure bandage in many cases left much to be desired, therefore the veterinary surgeon must see that the owner was capable of applying an effective dressing before entrusting him with the post-operative care of the wound.

The Opener

Dr. P. M. Biggs, in opening the discussion, said that his experience had been in only one rather small facet of the many that had contributed to the advance in understanding of tissue grafting over the past 10 years or so. That had been experimental in nature and concerned with what Dr. Payne had described as a homograft reaction in reverse, or what was now more commonly termed the "graft-against-host" reaction. He had no clinical experience of tissue grafting and for that reason was very interested in Mr. Neal's paper.

The organising committee should be congratulated on including in the Congress a short symposium on tissue grafting. Dr. Payne's excellent and comprehensive paper had shown the considerable advances which had been made during the last 10 years towards an understanding of the problems involved in the grafting of tissues, together with the impact those advances had had on the knowledge of immunological development and abnormalities of animals.

The papers had dealt with two very different problems of tissue grafting. Dr. Payne's paper was concerned with the immunological difficulties of the grafting of tissues from one animal to another of the same or differing species, a homograft and heterograft respectively. Mr. Neal, on the other hand, described the use of skin autografts and therefore was primarily concerned with the sur-

gical problems of grafting. It was to be hoped that the latter aspects of tissue grafting would be discussed by members present who were better qualified than he was.

Dr. Payne had described the concepts which had developed from recent work in tissue grafting. He had discussed the homograft reaction, actively acquired tolerance and, briefly, the graft-host reaction. Dr. Biggs said he wanted to define those terms a little more positively and, where possible, show the practical aspects of those concepts.

A foreign tissue graft was rejected by a mechanism which had been termed the homograft reaction. The rejection of a homograft was an immunological process and was dependent on a differing genetic constitution or donor and host. The exact mechanism which caused a graft to die was not yet fully understood. However, it was apparent that the action of humoral antibodies was sufficient to destroy isolated cells in the form of a suspension, but with "solid homografts" living lymphoid cells were necessary (Medawar, 1960). It was known that antigens responsible for the homograft reaction were associated with the cells and not the matrix of a tissue and their antigenic specificity was under genetic control. Work with highly inbred strains of laboratory animals had shown that there were both strong and weak antigens associated with the homograft reaction. The presence of strong antigens evoked a more rapid homograft reaction than the weak. However, from the practical point of view, the weak antigens were as important where long-term survival of the graft was required.

One could see then that it would be possible to graft tissue successfully from a donor whose transplantation antigens were completely represented in the host. The converse would not have to be true unless there was a likelihood of a graft-against-host reaction, that is, where the graft contained immunologically competent cells, when donor and host would have to be co-isogenic for the genes controlling the transplantation antigens. However, there was some evidence to show that the weak transplantation antigens were relatively ineffective in the graft-against-host reaction. Unfortunately the number and possible combinations of transplantation antigens appeared to be so diverse that it would be rare to find such matching in other than monozygotic twins and highly inbred laboratory animals and their crosses. Of course, the chances of success were greater between sibs and between parents and offspring than between randomly chosen donors and hosts. They were the only situations where homografts could be successful from the genetical standpoint.

Apart from monozygotic twins there was one other natural situation where homografts would be successful, which had already been mentioned by Dr. Payne, that is, naturally acquired tolerance which was seen between dizygotic twins which had been chimaeras since early foetal life due to a shared placental circulation. Successful skin homografts had been described in cases of that type in cattle (Anderson, Billingham, Lampkin & Medawar, 1957) and more recently in sheep (Moore & Rowson, 1958).

At that point Dr. Biggs added a few points to the concept of tolerance put forward by Dr. Payne. Medawar (1960) had recently defined tolerance as representing "... a delay in the development of specific immune reactivity that is brought about by the exposure of animals to antigens before they have become immunologically mature." He qualified that by saying "If this exposure to antigen is of short duration, the delay will be slight; exposure of the young animal to larger doses, or to smaller doses for longer times, prolongs the period of tolerance; and if exposure to antigen is continued indefinitely, the state of tolerance will be permanent." For that reason the induction of tolerance with living cells should be permanent if the state of chimaerism was permanent. Even that definition might soon need modifying. The strict specificity of tolerance had been thrown into doubt in the heterologous system at least, by the report of a turkey, which had been made tolerant of the tissues of one chicken, accepting heterografts from other chickens and one other turkey (Hasek, 1959). In the same communication, Hasek showed that in birds it was possible to induce a multiple tolerance. He was able to induce tolerance in young ducklings to randomly chosen skin donors by the inoculation of pooled samples of cells taken from a number of ducklings. It was even possible that populations of cells existed in adults which were capable of being made tolerant as had been suggested by Loutit (Medawar, 1960) and Simonsen (1960) for certain experimental situations.

Most of current knowledge of the time relationships of the tolerant period through the transition or null period to the final state of immunological maturity had been derived from experiments with laboratory animals. The ages at which mice and rats could no longer be made tolerant to tissue antigens, mentioned by Dr. Payne, demonstrated that there was a species difference. There might also well be a difference within species with different types of antigens. Considerable work had been done with soluble and bacterial antigens in the domestic species but with conflicting results in many cases. However, the point he desired to make was that there was very little knowledge of those relationships for tissue grafting in the domestic species. Most was known about the domestic chicken which had been used experimentally for much of the fundamental work on tissue immunity. Induction of tolerance in the chicken was no longer possible 12 hours after hatching. The null period or transition phase lasted for a variable period of time but was somewhere in the region of 7 to 10 days. Schinkel and Ferguson (1953) had shown that in sheep, skin homografts were invariably rejected by 80 to 117 day old foetal lambs. The tolerant period, therefore, appeared to be prior to that time in sheep. There was some evidence that puppies three days old were still in the tolerant period. Albert, Lejeune, Moureau and Andre (1959) and Puza and Gambos (1958) obtained a variable degree of tolerance to grafts of skin from donors of total blood transfusions in 3-day-old puppies. No graft-against-host reaction was noted; however it was as well to point out that there was some risk of that reaction attached to whole blood injections of neonatal animals.

The eventual solution of the homograft problem would undoubtedly come from a better understanding of the mechanism of the homograft reaction. Of course, the aim was to suppress in some way the immune response, although encouraging results might come from attempts to produce "adaptation" (alteration of the antigens on the surface of cells) in grafts. He agreed with Dr. Payne that the most hopeful approach at present lay with the study of the several types of immunological unresponsiveness which had been described. Four of those had been mentioned: actively acquired tolerance, "radiation tolerance," immunological paralysis and the Zulzberger-Chase phenomenon.

It could be concluded, for the present at least, that the ideal graft was not the homograft but the autograft. With an autograft there were no immunological problems, but only surgical ones such as the rapid provision of a good blood supply and the immobilisation of the site. They had already been discussed by Mr. Neal. However, the applications of autografts were limited and there were occasions where an autograft was impossible. It was not always necessary for the whole graft to survive or even for part of it to survive indefinitely. There were occasions when the only requirement was the provision of a temporary mechanical support which would eventually be replaced by host tissue. The rapidity of the homograft reaction depended partly on the number of living cells in a graft and the availability of their antigens to the host's immune mechanisms (Hyatt, 1960). The matrix in which the cells were embedded did not appear to be responsible for eliciting that reaction. On the contrary, it afforded some degree of isolation of the cells of the graft from the hosts' immune mechanisms. The extreme example of that was cartilage. Therefore, from the practical point of view homografting must be mainly concerned with the matrix and for the success of such a homograft a low cell and high matrix content was necessary. Human homografts which functioned with a reasonable degree of success were: bone, fascia, dura, cornea, artery and, of course, cartilage (Hyatt, 1960). Those types of homografts raised the problem of tissue storage. That was a large subject which there was not time to discuss.

At present it could be concluded that there was little that

had come from modern work on tissue grafting that was of practical application to clinical veterinary surgery. It was hoped that eventually the homograft problem would be solved. That would put in the hands of the veterinary surgeon the means of grafting tissues from one animal to another. Whether there would be much call for that, he joined Dr. Payne in hoping that some points would be raised in the discussion. However, whatever the answer to the question might be, he supported Dr. Payne's suggestion that a greater part should be taken, where possible, by veterinarians in contributing to knowledge of the homograft reaction. The dog was probably the species which would benefit most from the solution of the homograft problem. Chronic nephritis was not uncommon in the dog and the homografting of kidneys could be an important part of a small-animal practice. It could be suggested that records should be kept of donors and recipients of large or total blood transfusions. In those cases the results of grafting at a later date, where possible or necessary, would be of interest. The treatment of cases of lymphatic leucosis in the dog could be attempted, where the equipment was available, by total body irradiation followed by the inoculation of foetal or puppy bone marrow and spleen cells. Those were only a few suggestions which it was hoped might stimulate discussion.

Even if the future of grafting in the domestic species did not appear to be as important as in human surgery, the concepts which had been so ably presented by Dr. Payne were of considerable importance to the understanding of disease. He had already mentioned the diseases in man believed to be due to an auto-immunity. It seemed likely that there were some in the domestic species where auto-immunity played its part. It was significant that quite recently the graft-against-host reaction had been likened to malignant lymphomas (Kaplan & Smithers, 1959) and to a more general concept of neoplasia by Tyler (1960).

Even though the likelihood of a successful homograft was at present not much improved and therefore grafting was still primarily a surgical technique designed to avoid the homograft reaction, the concepts outlined by Dr. Payne had considerable relevance to veterinary science and were fundamental to the biology of disease.

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The General Discussion

Dr. E. J. L. Soulsby (University of Cambridge) referred to the question of immunological incompetence in various animals, and said that immunological incompetence, particularly in the young animal, was probably of great importance in the epidemiology of many diseases. Work was going on in Cambridge with reference to this phenomenon of parasitic disease. It was found that in many areas of the world, the epidemiology of certain parasites could not be explained by the normal host relationship one would expect in the laboratory.

If, on the other hand, animals were infected at birth, it was found that such animals may have a delayed immune response to a subsequent challenge infection and may in fact be completely susceptible to reinfection.

For example, in *Cysticercus bovis* infection in cattle in Kenya cysts are found to be viable in animals aged up to 5 or 6 years and this is at variance with Australian findings that cysts are normally destroyed in an animal within 9 months of infection, thereafter the animal being immune to reinfection. If an animal is infected at birth with *C. bovis* not only are cysts fully viable after 10 months but the animal is also capable of being reinfected.

Dr. Payne had suggested that immunological incompetence might play an important part in infectious diseases. Dr. Soulsby also suggested that it might play an important part in the epidemiology of many other diseases which animals might contract when they were born, particularly in endemic areas.

Mr. W. Beaumont (Totnes) said he was interested in the prevention of granulomata, and suggested that the type of dressing might have some bearing on the matter. Professor Wright operated on several horses for fistulous withers, and in the dressing sulphonamide powder was used which gave rapid granulation. Perhaps it was not a good dressing to put on a horse's leg for that reason. Mr. Neal referred to firm pressure bandage dressing, and it would be interesting to know whether the result was due to pressure or whether it was due to sealing off all air from the wound. These wounds could be sealed off from the air with an oily dressing, healing was excellent and there was seldom granulation.

As to the removal of dead tissue from the wounds, in his view strong antiseptics were used too much. A normal saline solution tended to prevent granulation.

Mr. Neal mentioned a reaction to an elastic adhesive bandage, and it would be of interest to know what type of tissue was involved.

Mr. James Roberts (Equine Research Station, Newmarket) said that the rate of rejection of skin graft tissue was accelerated by the presence of infection and in the transplantation of split thickness skin grafting it was a considerable advantage to prepare the donor material several days in advance of the operation, the preparation aiming at disinfecting as much as possible. The acceptance area should also be dressed for about three days at least with some antiseptic or antibiotic preparation to keep down the presence of infection. The top layer of the recipient site should be treated under completely aseptic conditions, and if those factors were given due attention, the incidence of rejection of the transplanted tissue was much less.

Mr. A. L. Ogden (Farm Livestock Research Station, Stock) referred to Dr. Payne's statement that in healthy untreated adults foetal tissue transplants could survive. This observation was relevant to the so-called "immunological problem of pregnancy." Dealing with this problem Medawar defined 3 reasons why a foetus can survive *in utero*. These are:—

Anatomical separation;
Antigenic immaturity of the foetus;
and Maternal Desensitisation to antigenic response.

Woodruff, when trying to determine the most important of these reasons, found, in rats and rabbits, that foetal tissue transplanted to *ex utero* sites in its own dam was treated as a typical homograft and rejected. Further if such transplantation was preceded by skin transplantation from the sire of the foetus to the dam then the subsequent foetal tissue graft experienced accelerated rejection, a typical second set response. Woodruff considered these experiments evidence for the primary importance of anatomical separation in ensuring foetal survival *in utero*. Clearly Dr. Payne's experiments could reverse this emphasis and the speaker would be grateful if he could elaborate on the conditions under which he found tolerance, or relative tolerance, to placental and foetal homografts exhibited.

The Replies

Dr. J. M. Payne, in reply, agreed that Woodruff did postulate anatomical separation in the uterus, but this might not be the only factor because extra uterine pregnancy was possible although rare. Homografts of foetal tissue in rats

(*Concluded at foot of col.* 1 *overleaf*)

The Scientific Exhibition at Congress

From a Correspondent

One of the advantages of holding our Annual Congress in a university city is the availability of adequate lecture theatres and laboratories. The former add to the comfort of the audience thus making the speaker's task easier, and the latter enable demonstrations of a scientific nature to be presented to their best advantage. In both respects this year's congress in Oxford was particularly fortunate, and the congress committee was able to stage an exhibition of scientific works in the Human Physiology Laboratory. Demonstrations covering many disciplines were received from institutes and individuals throughout the country. In the past some scientific exhibitions have been rather formidable affairs with demonstrations numbering upwards of 100. This year's was not quite so ambitious but with its 30 exhibits there was plenty of interest and the whole exhibition could be covered in about 1 to 2 hours which is about all most people could afford out of an already full week. The individual demonstrations were again of the high standard we have come to expect, and most exhibitors had successfully resisted the temptation to present too much detail to the detriment of their main theme.

The number of demonstrations relating to poultry was a welcome indication of the profession's interest in this field. S. F. M. Davies's (Weybridge) exhibit dealt with the pathology and differential diagnosis of coccidiosis in the fowl. The lesions caused by each of the 4 common pathogenic species of Eimeria in the fowl—*E. acervulina, E. maxima, E. necatrix, E. tenella*—were illustrated by large colour photographs of striking quality, and a series of black and white diagrams depicted the regions of the alimentary canal normally invaded by these 4 parasites and by *E. brunetti*, a species only this year confirmed as an additional cause of intestinal coccidiosis in Britain. The principal characteristics which would assist differential diagnosis were also listed.

Some of the more common conditions of poultry calling for differential diagnosis by the veterinary surgeon were shown by M. H. Fussell (London). The demonstration emphasised that much useful information could be obtained by the naked eye or by means of the standard laboratory microscope. Here again the excellence of the coloured photographs and their attractive presentation were a notable feature of the exhibit.

J. M. Beattie's (Houghton) demonstration of gaseous metabolism in chick embryos and young chickens was evidence of the profession's growing interest in the more fundamental aspects of veterinary research. Charts showed that during hatching the volume of oxygen required by the chick increases by over one and a half times. Thus, at an incubator temperature of 37.7°C. (100°F.) the full-term embryo consumes 30 ml. per hour, and the hatched chick 52 ml. per hour. Subsequent to hatching, oxygen uptake increases rapidly. At first the sexes cannot be differentiated, but at 500 gm. (1.1 lb.) the males consume 25 per cent. more oxygen than the females. At 1 kg. (2.2 lb.) this increases to 40 per cent. It is a pity that the original plan to have the apparatus working could not have been followed through.

Two further poultry exhibits were on view. J. G. Campbell (Edinburgh) demonstrated typical bone lesions of *Osteopetrosis gallinarum*, the viral aetiology of which has now been established. Certain secondary lesions of soft tissues were also illustrated particularly the neoplastic-like lesions of the striated muscle. W. G. Siller (Edinburgh) put on a demonstration of ventricular septal defects in fowls. The exhibit illustrated very clearly the typical appearance of hearts with abnormal interventricular communication. It

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Skin Grafting in the Treatment of Granulating Wounds of the Horse's Legs.—*Concluded.*

and mice only took permanently when the homografts barrier between donor and recipient was weak.

Mr. P. A. Neal, in reply, referred to the question of the use of sulphonamide as a dressing for horse wounds, and said that he could defend it in that large muscle wounds on the flank, neck, etc., healed extremely quickly under sulphonamide treatment, without the formation of excess granulations. A similar answer applied to the question of whether it was the pressure of the bandage or the bandage sealing the wound off from the air which prevented granulation. Wounds of the trunk were not bandaged and were thus completely exposed to the air, yet they did not granulate excessively. He felt convinced that the reason for exuberant granulation was the constant breakdown of granulation tissue rather than the other two factors mentioned.

As to the elastic bandage, he had applied it in many cases without untoward result but in two an acute dermatitis resulted. It was so acute that in both cases it was thought that a very considerable area of skin would be lost. This, in fact, did not occur but it was necessary to abandon the use of elastic bandage in those cases.

As to the preparation of the recipient area, it was dressed with anti-bacterial drugs for at least 10 days prior to the grafting.

He had tried "Nobecutane" as a dressing but not with any success. He had found that it did not adhere well to the granulating area.

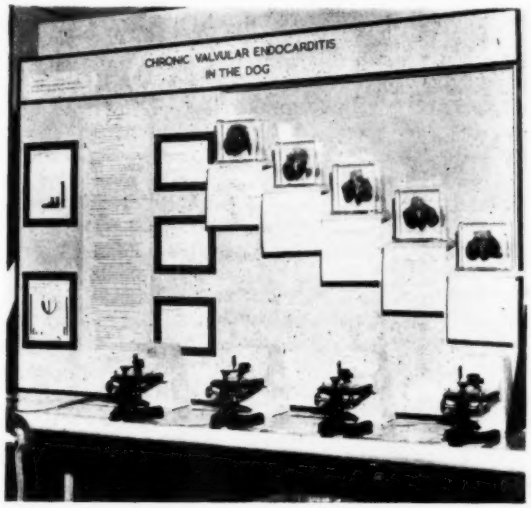
He had not had any experience of immediate grafting because the majority of his cases were of a long standing nature when presented for treatment. When this was not the case the wounds were not of a suitable nature for immediate grafting.

He was a little afraid of immobilising either a carpus or a tarsus in a vigorous horse for he had had cases in which such immobilisation caused the horse to become frenzied when it attempted to move, becoming cast, breaking up the dressing and re-injuring the wound.

Treatment with cortisone had been recommended in the United States. He had tried the local application of cortisone ointment to wounds but found that it did not significantly retard the formation of granulation tissue.

A vote of thanks to the authors, proposed by the Chairman, was carried by acclamation, and the session was terminated.

was pointed out that while in man such defects have the severest consequences, in fowls they are compensated by either spontaneous post-natal closure or by the development of lip-like valves which prevent the left to right shunt of blood. Thus most birds with septal defects show no clinical signs. The fact that 84 per cent. of one in-bred line of poultry was affected suggested a genetical basis for the condition.



"Chronic Valvular Endocarditis in the Dog." Dept. Veterinary Pathology, Royal (Dick) School of Veterinary Studies. Photograph by Dennis Boxall.

Another exhibit with a genetical bias was that of I. G. Shaw (Worcester) who demonstrated "B" or "Welsh" border disease of sheep, a disease first seen in Kerry Hill and Clun Forest sheep and more recently in Suffolks. This was a compact and easily followed little exhibit in which specimens of fleece and pelts from normal and diseased lambs were shown. The long "halo" hairs of affected pelts were well demonstrated. The cause was stated to be unknown but was believed to be associated with a genetically determined metabolic defect.

Sheep were figured in a number of the other exhibits. In fact this year sheep and poultry between them accounted for one half of the exhibition. T. E. Gibson (Weybridge) summarised graphically the results of 4 years' work on the epidemiology of *Nematodirus battus*, and pointed out that from the information presented it could be deduced that nematodiriasis could be largely prevented by reserving for the lamb crop each year a piece of land (a new ley, for example), upon which sheep had not been run the previous spring.

An exhibit of interest to helminthologists was that of M. G. Christie (Edinburgh) who demonstrated a neat method of determining the natural breakdown rate of sheep faeces on pasture. Yellow plastic markers were inserted into the faeces pellets and were recovered from the sod of turf after the faeces had disappeared. An indication of the range of times required for complete disintegration of different samples under various conditions would have added greatly to the usefulness of this demonstration.

Eperythrozoon infection in sheep was demonstrated by A. Foggie (Edinburgh). The demonstration dealt largely with the experimental disease in hoggs and lambs and showed examples of the parasite in blood films. Experiments indicating an apparent interference between infection with tick-borne fever and infection with eperythrozoon were illustrated.

J. G. Hall (Edinburgh) presented a demonstration of differing serum types in sheep. By means of starch-gel electrophoresis he showed individual differences in the beta-globulin component. The heritable nature of these differences was illustrated in serum samples from a family of sheep. The use of models of sheep enlivened this rather specialised exhibit.

Another demonstration of the use of starch-gel electrophoresis in the study of animal sera was that of A. L. Ogden (Stock) who compared the distinctive features of sera from a variety of farm livestock. The exhibit consisted of a series of stained gels and photographs showing the existence and genetic control of distinct variants in one electrophoretic zone.

A strikingly colourful exhibit was that of B. S. Cooper (Thurgarton) who used a series of colour photographs to demonstrate the clinical features of contagious conjunctivo-keratitis of sheep and infectious conjunctivo-keratitis of cattle. The excellence of the colour prints in this and other exhibits was a credit to the exhibitors, and it is perhaps worth recording that the great improvement in colour film in recent years enables much more accurate colour representation to be attained. Scientists who would not have considered using the method a few years ago, are now doing so with confidence—and obviously with excellent results.

The largest single demonstration was a collaborative effort by Mrs. Batty, Dr. Warrack, Dr. Sterne and Mr. Harris (Beckenham) devoted to the pathogenic Clostridia. The demonstration covered the morphological, cultural and biochemical properties of the commonly encountered Clostridia and continued with the typing of *Clostridium welchii* by serological methods and by the Ochterlony gel-diffusion technique. There were also actual examples of the tests employed. In the first section, colonial forms on blood agar plates, lecithinase activity in broth cultures, nitrate reduction tests, the vanillin test for indole production, tests for urease, organisms growing in semi-solid sugars, peptone water sugars, brain media, coagulated egg media and Bromo cresol milk media, and the effects of proteinases and lecithinases on quartered plates of solid medium containing asocoll, lecithovitellin casein and coagulased serum, were shown. The second section showed *in vitro* tests for the presence of lecithinases and haemolysins, tests in guinea-pig skins for the necrotising toxins, *in vitro* tests for proteinases and for hyaluronidase, and specimens of gel diffusion plates showing the lines produced by representative *welchii* filtrates together with plates showing non-specific precipitation lines. There was also a small section showing methods of discriminating between *Cl. chauvoei* and *Cl. septicum*

on the basis of neutralisation tests of the specific haemolysins and hyaluronidases.

Blood transfusion in horses was featured in a demonstration mounted by W. C. Miller (Newmarket). The principles on which transfusion depends were outlined, and it was emphasised that while, in an emergency, the cross-matching of donor and recipient's blood is not of primary importance in the horse, if successive transfusions are required it is most important to ensure that a donor with compatible blood is chosen. Various techniques for collection and transfusion of blood were shown and suitable apparatus as used by the Blood Transfusion Service, including the new disposable polythene containers, was on view. Indications were given of the conditions in which (a) blood transfusion can be a very valuable aid to recovery and (b) in which it is the only technique available (*e.g.* in haemolytic disease of the newborn foal).

An anonymous exhibit staged by the Ministry of Agriculture drew attention to a toxin factor which was encountered in certain batches of groundnut meal. The exhibit gave details of the number of outbreaks encountered in turkeys, pigs and calves and described the symptoms, gross pathology and histopathology. This was a very large exhibit but seemed to lose some of its impact through being spread out too much—a most unusual fault. The common fault at these exhibitions is too much information in too small a space but for this the organisers have to accept some of the blame as they are compelled to ration their available space sometimes to the detriment of an exhibit.

One exhibit which could have done with a little more space was that of J. C. Whitney (Edinburgh). By means of beautifully mounted specimens of dogs' hearts he showed a selection of cases of chronic valvular endocarditis. In a series of 100 unselected dogs Whitney found 37 such cases and relates them to the high incidence of mitral insufficiency in cardiac disease of the dog. Histological specimens were also on view and the absence of any bacterial endocarditis in the series of 100 dogs was noted.

Another exhibit of great interest to the small-animal practitioner was that of J. M. Hime (Newmarket). He showed a series of X-ray plates demonstrating the use of various contrast media in small-animal radiography. The use of air as a contrast medium was particularly well shown. As Mr. Hime pointed out air is relatively safe, produces no side effects and is cheap!

J. Keppie (Porton) and his colleagues presented a demonstration on intrauterine erythritol. By means of graphs and tables he showed that in a chemical survey of the tissues of pregnant cows, erythritol, a substance thought to occur only in algae and lichens, was found in foetal tissues. Erythritol was shown to enhance the growth of *Br. abortus* in culture and to increase its infectivity for calves.

The biological assay of swine erysipelas vaccines was demonstrated by K. S. Chodnik (Greenford). The demonstration showed by means of charts and coloured photographs the method of using the pig as a test animal. This exhibit and those of D. M. Berry, S. A. Keeble, Mrs. K. Heath (Greenford) and J. B. Derbyshire (Compton) all used a method of relief lettering which was very pleasing in effect. Mrs. Heath's exhibit also showed a remarkable photograph of a leptospira taken under the electron microscope. The photo, probably the best yet taken, showed very clearly the spiral protoplast winding round the axial filament—both unbroken.

S. B. Kendall (Weybridge) showed preserved specimens of tissue and colour transparencies of the lesions caused by the injection into the leg muscle of rabbits, sheep and cattle of (a) pure carbon tetrachloride and (b) carbon tetrachloride together with either liquid paraffin or the related "Diloma D." Necrotic tissue was still present one month after injection. In two months' time it had been replaced by fibrous tissue which remained for at least six months. This exhibit and that of A. Brownlee (Compton) were both illustrative of the great flexibility of perspex as a material for the presentation of preserved specimens. Mr. Brownlee's exhibit consisted of a series of very beautifully mounted specimens of portions of rumen, omasum and intestine of calves and cattle showing the effects of different diets on the development of the rumen papillae, irregularities in development of the omasal folds, and regression of the terminal Peyer's patch with advancing age.

The Hospital Section of the Zoological Society of London again contributed to the scientific exhibition. As in the past the exhibit dealt with more or less usual phenomena but in unusual animals. This year the demonstration staged by O. Graham-Jones (London) illustrated, by means of X-ray pictures, the repair of fractures in such animals as the eagle, cockatoo, swan and llama.

Visitors to the congress who took the trouble to seek out this exhibition of scientific work stayed to spend an instructive hour in pleasant and colourful surroundings. Dr. Holman, chairman of the scientific committee, and Dr. Rankin, who was responsible for staging the exhibition, are to be congratulated on a very fine effort. The Association's thanks are due to them, and to Sir Lindor Brown, Waynefleet Professor of Physiology, for making such excellent facilities available.

1962 CONGRESS HOTEL ACCOMMODATION

Members of the Association may be glad to have early notice that the Grand Hotel, Scarborough, will be the headquarters hotel for next year's Congress, which takes place from September 16th to 22nd.

Although a block reservation has been made by the Association, we should like to emphasise that members should make their individual bookings *direct with the management*, and not through the B.V.A. It would be advisable, however, to mention when making bookings that the visit is connected with the B.V.A. Congress, so that the management can make the necessary reservations against the B.V.A. allocation of rooms.

Prophylaxis under Continuous Exposure to the Risk of Natural Infection with Trypanosomiasis by Tsetse Flies

A Comparative Trial of Metamidium Chloride, Antrycide Pro-salt and Antrycide Methylsulphate

BY

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SUMMARY.—Metamidium at 1 and 2 mg. per kg., Antrycide Methylsulphate at 5 mg. per kg. and Antrycide Pro-salt (R.F.) at the recommended dosage rate were used in groups of animals under continuous G. morsitans submorsitans *risk at an average density of 13.5 flies per patrol mile. The mean break-through period of survivors was 94, 125, 53 and 60 days respectively. In the Metamidium groups there appears to be no correlation between injection site reaction and prophylactic period.*

Retreatment of the Metamidium group animals at the original dose was generally effective, but homidium, used as Ethidium Chloride and Novidium,† was less effective.*

Introduction

BEFORE the present trial, Metamidium (the *p*-amidinophenyldiazamino derivative of 2:7-diamino-10-ethyl-9-phenylphenanthridinium chloride (homidium chloride, B.Vet.C., 1959) had not been tested in Nigeria as a prophylactic under continuous risk of trypanosomiasis infection, though at a dose of 3 mg. per kg. it had been compared with Prothidium (2-amino-7-(2-amino-6-methyl-4 pyrimidylamino)-9-p-amino-phenyl, phenanthridine 10:1'-dimethyl-bromide) and Antrycide Pro-salt in a toxicity trial (Kirkby, 1960). Metamidium was found too toxic at this dosage rate and the protection afforded by it, under the very light risk of infection to which the cattle were exposed in this earlier trial, was poor. The experiment now described was designed to compare the protection against natural infection afforded by Metamidium at 1 mg. per kg. and 2 mg. per kg. with that conferred by Antrycide Pro-salt and Antrycide Methylsulphate.

Materials and Methods

Forty-three cattle were purchased in a tsetse-free area in northern Katsina Province and were trekked to the Agricultural Station at Daudawa, where blood slides were taken; all were negative for trypanosomes. After weighing, the animals were divided at random into 5 groups and received the treatments shown in Table I.

Metamidium was given intramuscularly into the biceps femoris muscle, midway between the tuber coxae and the tuber ischii and about 5 inches lateral to the mid-line.

* Boots Pure Drug Co., Ltd.
† May and Baker, Ltd.

The Antrycide used in Groups 3 and 4 was given subcutaneously, approximately 6 inches posterior to the point of the elbow.

The cattle were treated on April 17th, 1960, and then trekked 35 miles from Daudawa, where there are no facilities for weighing. Thereafter, thick blood smears were made from the cattle on 3 consecutive days weekly throughout the course of the observation period.

TABLE I
GROUP TREATMENTS

Group	Number of animals	Drug
1	11	Metamidium at 1 mg. per kg.
2	12	Metamidium at 2 mg. per kg.
3	5	Antrycide methylsulphate at 5 mg. per kg.
4	10	Antrycide prosalt. Revised formulation. Recommended manufacturer's dosage.
5	5	Untreated controls.

The cattle were grazed in an area infested with *Glossina morsitans submorsitans* at an average density of 13.5 flies per patrol mile. No cattle undergoing drug trials had been there before and local cattle owners do not use the area for grazing, though they pass their stock through it occasionally. The cattle were first exposed to risk of infection on April 20th, 3 days after being treated.

Results

General Health of the Cattle

There were several cases of babesiasis before routine spraying with Toxaphene Emulsifiable Concentrate could be arranged and it is likely that the 4 animals which died, 2 in Group 1 and 2 in Group 3, had babesiasis, though their blood films were negative. Otherwise, the animals remained in good condition until late in the rains, when there were several cases of streptothrichosis.

Injection Site Reactions

Cattle in Groups 1 and 2 when examined on May 5th, 18 days after treatment, showed fairly pronounced, firm swellings, but these caused lameness in one or two animals only. Pain was not a feature of the swellings. At the 47th day after treatment, the swellings were still pronounced, but

in most cases they were about half the size they had been 18 days after treatment.

Swellings in 2 animals of Group 2, numbers 22 and 29, persisted for months and were the largest in all the groups. Initially they were hard, but by the 47th day had become soft and fluctuating, although there was little pain or heat. The volume of the swellings in each of these animals at this time was in the region of 500 to 600 ml. Number 29 was losing condition and it was decided to slaughter it on September 11th, 147 days after treatment, and examine the injection site lesion.

Post-mortem examination showed no skin involvement over the injection site and the subcutaneous tissues were normal. Incision into the swelling released over a litre of dark brownish fluid, odourless and non-purulent. Stained smears showed no bacteria present in this fluid. It was contained by a $\frac{1}{4}$-inch thick fibrous capsule, which had pillars joining opposite sides, and ridges on the walls similar in appearance to those on the rumenal wall. There was a loose net of fibrous necrotic tissue in the cavity. Other organs and tissues of the animal were macroscopically normal and no intestinal parasites were seen.

Unfortunately, the injection site lesions of number 22 were not examined when it was slaughtered due to streptothrichosis, but the body tissues appeared normal.

Cattle in Groups 3 and 4 showed only slight swellings when examined 18 days after treatment, but they appeared to have lost condition more than those in the other groups.

No animal in any group died as a result of drug toxicity.

Control Group

The 5 animals in the control group were allowed to die after becoming infected, the mean period from first exposure to death being 67 days. They became positive to both *Trypanosoma vivax* and *T. congolense*, though the former was much more numerous. Table II shows the day after initial risk that infection was first noted and the period between exposure and death. It would appear from this table that the strain of *T. vivax*, like the Doka strain used in 1958-59 at Daudawa (Kirkby, 1960), is not very pathogenic.

TABLE II
PERIOD BETWEEN INITIAL RISK AND INFECTION AND DEATH OF CONTROL ANIMALS

Ox number	Days from exposure to patent infection	Days from exposure to death
37	29	75
39	22	50
41	22	74
42	22	68
43	22	68

Blood was inoculated into 8 sheep from number 43. Three of these sheep were treated with homidium bromide at 1 mg. per kg. on June 10th and 3 more on June 17th. Up to 140 days after treatment the 6 sheep showed no trypanosomes in thick blood smears.

The 2 untreated sheep were housed in a fly-proof pen and have remained positive to *T. vivax* since inoculation for one year.

It would appear from these results that the strains of trypanosomes from the trial area are susceptible to homidium bromide at 1 mg. per kg.

Protection Periods

Table III summarises the prophylactic results. The detailed results of each group, as well as particulars of the individual injection site reactions, are given in Tables VII to X.

Treatment of Cattle in which Breakthrough Infections Occurred

(a) *Group 1—Metamidium at 1 mg. per kg.* As breakthrough infections occurred in this group, an attempt was made to determine whether retreatment at the original dosage rate of Metamidium would be effective and also to study the value of retreatment with Novidium* and Ethidium chloride†, both at 1 mg. per kg.

The results are given in Table IV.

All cattle, except number 8, were removed from tsetse risk after initial breakthrough.

Retreated animals were taken from the area of tsetse risk to Maska, which is tsetse free, with the exception of number 8, which remained under exposure. It will be seen that in four out of five cases, animals treated with homidium salts were not cured, but on further retreatment with Metamidium remained negative to the end of the observation period.

Retreatment with Metamidium at the original dosage rate apparently eliminated the infection in 2 out of 3 animals. The third animal was intermittently scantily positive for 28 days and then remained negative to the end of the observation period. This phenomenon has been observed in previous prophylactic trials, *e.g.* an animal may show trypanosomes in its blood for one day only during the trial. The reason for this is not known, but it makes the interpretation of results difficult. Trypanosomes were not seen in blood films from the animal retreated with 0.5 mg. per kg. until 100 days later.

(b) *Group 2—Metamidium at 2 mg. per kg.* Two animals were given homidium at 1 mg. per kg. and removed to Maska. One animal relapsed after 18 days and was retreated with Metamidium at 1 mg. per kg. and remained negative to the end of the observation period. The other animal showed trypanosomes for 1 day only (day 30) and subsequently remained negative to day 204.

The other 8 animals retreated were given Metamidium at 2 mg. per kg. in the gluteal area on

* Proprietary name of May & Baker, Ltd., for homidium chloride, B.Vet.C., 1959.

† Proprietary name of Boots Pure Drug Co., Ltd., for homidium chloride, B.Vet.C., 1959.

The word "metamidium" in this paper refers to the chloride hydrochloride.

the opposite side to the original injection. Two were removed from tsetse risk and the other 6 remained exposed to infection.

One animal, number 22, was slaughtered due to streptothrichosis at day 199 after its original treatment. It had remained consistently negative under tsetse risk. Results are given in Table V.

(c) *Group 3—Antrycide Pro-salt.* The 10 animals in this group were treated when infection had broken through in the field and housed in fly-proof pens at the Agricultural Station at Shika. Results are given in Table VI.

From the Table VI it will be seen that 6 animals were first retreated with homidium at 0.5 mg. per kg. and 4 with Metamidium at 0.5 mg. per kg.

Of those treated with homidium, the drug failed to clear trypanosomes from the blood of 3 animals. Two were retreated with homidium at 1 mg. per kg. and, since this did not effect a cure, they next received Metamidium at 1 mg. per kg. and remained free to the 90th and 121st days respectively, when they were sold.

The third animal was retreated with Metamidium at 0.5 mg. per kg. but trypanosomes were seen in thick films at the 79th day.

In 2 other animals homidium cleared the blood of trypanosomes for a short period but retreatment with Metamidium, using in one animal 0.5 mg. per kg. and in the other 1.0 mg. per kg., was not effective.

The sixth animal was apparently cured with homidium at 0.5 mg. per kg.

TABLE III
INFECTIONS IN CATTLE DURING THE PERIOD OF EXPOSURE TO RISK

Group	Days post treatment																	
	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190
1	0/9	0/9	0/9	0/9	0/9	1/9	2/9	4/9	6/9	7/9	8/9	9/9	—	—	—	—	—	—
2	0/12	0/12	1/12	1/12	1/12	1/12	2/12	3/12	3/12	3/12	4/12	6/12	8/12	9/11	9/11	9/12	10/11	—
3	0/3	0/3	1/3	2/3	2/3	2/3	3/3	—	—	—	—	—	—	—	—	—	—	—
4	0/10	0/10	0/10	0/10	6/10	8/10	10/10	—	—	—	—	—	—	—	—	—	—	—
	Days to infection																	
Controls	0/5	5/5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Numerator = Number of cattle showing infection. Denominator = Number of cattle in group.

Of the 4 animals receiving Metamidium at 0.5 mg. per kg. 2 were cured and 1 died before a cure could be assessed. Metamidium failed to clear trypanosomes from the blood of the fourth animal, but retreatment at 1 mg. per kg. effected a cure.

Discussion

In Groups 1 and 2 there does not appear to be any connexion between the injection site reaction and the protection afforded. The author had not previously used the gluteal site for Metamidium; the posterior thigh muscles and muscles behind the wing of the atlas had previously been found not completely

TABLE IV
RETREATMENTS OF ANIMALS IN GROUP 1

Ox number	Break-through day	First retreatment drug and dose	Break-through day	Second retreatment drug and dose	Remarks
1	95	Metamidium 1 mg. per kg.	—	—	Negative to day 156
3	102	Ethidium chloride 1 mg. per kg.	12	Metamidium 1 mg. per kg.	„ „ 140
4	75	Novidium 1 mg. per kg.	—	—	„ „ 170
5	69	Metamidium 0·5 mg. per kg.	100	—	Slaughtered due to streptothrichosis
7	81	Novidium 1 mg. per kg.	34	Metamidium 1 mg. per kg.	Negative to day 168
8	130	Metamidium 1 mg. per kg.	—	—	Animal remained under tsetse risk. *T. congolense* at day 188
10	116	Ethidium chloride 1 mg. per kg.	12	Metamidium 1 mg. per kg.	Negative to day 140
12	96	Metamidium 1 mg. per kg.	42	—	From days 42 to 70 intermittently positive, subsequently negative to day 156
21	88	Novidium 1 mg. per kg.	34	Metamidium 1 mg. per kg.	Negative to day 140

satisfactory (Kirkby, 1960); reactions in these sites were more marked than those in the present trial.

Since a good protection period was afforded in cattle of Group 1 in which there was only a slight reaction, probably due to the smaller volumes of solution injected, it should be possible to produce similar results in Group 2, either by dividing the dose of Metamidium between 2 sites, or finding an alternative injection site.

mg. per kg. was effective up to the time of slaughter at 100 days after retreatment but a cure cannot be claimed as breakdowns have occurred later than this, for example animal 11 in the Antrycide Pro-salt group became positive again at the 119th day after retreatment.

Ethidium chloride was not effective at 1 mg. per kg. but further retreatment with Metamidium at 1 mg. per kg. was. On the Shika Stock Farm and at the nearby agricultural Station at Samaru, the use of Ethidium chloride at the same dosage rate has given similar results. Further examination of the drug is being made.

Retreatment of Group 2 animals with Novidium at 1 mg. per kg. lead to early breakdown in the case of 1 animal and to the other being positive for one day only. The transient infection was at the 30th day after retreatment, a time when it is unlikely that

TABLE V
RETREATMENTS OF ANIMALS IN GROUP 2

Ox number	Breakthrough day	First retreatment drug and dose	Breakthrough day	Second retreatment drug and dose	Remarks
22	—	—	—	—	Negative to day 199 sold
23	82	Novidium 1 mg. per kg.	18	Metamidium 1 mg. per kg.	" " 149*
25	123	Metamidium 2 mg. per kg.	—	—	*T. congolense* day 174
26	117	" 2 "	—	—	Negative to sale at day 171
27	172	" 2 "	—	—	" " " 141
28	75	" 2 "	—	—	*T. congolense* at day 201
29	—	—	—	—	Negative to day 146 sold
30	130	" 2 "	—	—	" to sale at day 150*
31	144	" 2 "	—	—	" " " 150*
32	137	" 2 "	—	—	" " " 124
33	137	" 2 "	—	—	*T. congolense* day 125
35	39	Novidium 1 mg. per kg.	30	—	Day 30 for 1 day only then negative to day 204*

* Removed from tsetse risk.

It will be observed that in Groups 1 and 2, of the 18 animals which broke down, 16 showed *T. congolense* and only 2 showed *T. vivax*, whereas in Group 4 the figures were 4 *T. congolense* to 6 *T. vivax*. Retreatment breakthroughs were exclusively *T. congolense*. In Group 1, Metamidium at 1 mg. per kg., retreatment of breakthroughs at the original dosage rate was effective in 2 animals but not in the third, animal number 12. Metamidium at 0.5

Retreatment of Group 2 animals with Novidium at 1 mg. per kg. lead to early breakdown in the case of 1 animal and to the other being positive for one day only. The transient infection was at the 30th day after retreatment, a time when it is unlikely that

TABLE VI
RETREATMENTS OF ANIMALS IN GROUP 3

Ox number	Breakthrough day	First retreatment drug and dose	Break through day	Second retreatment drug and dose	Remarks
2	55	Novidium 0·5 mg. per kg.	Never became negative	Novidium 1 mg. per kg.	Became positive at day 14, given Metamidium at 1 mg. per kg. then negative to sale at day 90
9	54	Metamidium 0·5 mg. per kg.	—	—	Died day 15 after treatment ; death not due to trypanosomiasis and blood negative
11	74	Novidium 0·5 mg. per kg.	18	Metamidium 1 mg. per kg.	Became positive at day 119
17	75	" 0·5 "	—	—	Negative to sale at day 128
18	54	" 0·5 "	Never became negative	Metamidium 0·5 mg. per kg.	Slaughtered after becoming positive at day 79
24	67	" 0·5 "	5	" 0·5 "	Positive at day 79. Sold negative 39 days after being given metamidium 2 mg. per kg.
34	53	" 0·5 "	Never became negative	Novidium 1 mg. per kg.	At day 18 positive, then given Metamidium at 1 mg. per kg. Animal then negative to sale at day 121
36	67	Metamidium 0·5 mg. per kg.	Never became negative	Metamidium 1 mg. per kg.	Negative to sale at day 128
38	53	" 0·5 "	—	—	" " " 144
40	53	" 0·5 "	—	—	" " " 144

All above animals were housed in fly-proof pens after initial retreatment.

TABLE VII
GROUP 1.—METAMIDIUM AT 1 MG. PER KG.

Ox number	Trypanosome first noted	Days post treatment	Injection site reaction at the 18th day
1	T.C.	95	Very slight
3	T.C.	102	Pronounced, firm, with heat
4	T.C.	75	Slight
5	T.V.	69	Slight
6	—	—	Died at day 21 post-treatment, babesiasis ?
7	T.C.	81	Pronounced, diffuse and soft
8	T.C.	130	Slight
10	T.C.	116	Pronounced, but rather localised
12	T.C.	96	Slight
13	—	—	Died at day 18 post-treatment, babesiasis ?
21	T.C.	88	Slight

Mean breakthrough period in Group 1 was 94 days.

TABLE VIII
GROUP 2.—METAMIDIUM AT 2 MG. PER KG.

Ox number	Trypanosome first noted	Days post treatment	Injection site reaction at the 18th day
22	—	—	Fairly pronounced. Slaughtered due to streptothrichosis on day 199, still negative until death
23	T.C.	82	Pronounced
25	T.C.	123	Pronounced and hard
26	T.C.	117	Pronounced and diffuse
27	T.C.	172	Very pronounced and hard
28	T.C.	75*	Fairly pronounced and hard
29	—	—	Very pronounced, hard and hot. Slaughtered due to extensive injection site reaction at day 146. Negative until death
30	T.C.	130	Pronounced with heat.
31	T.C.	144	Pronounced and soft
32	T.C.	137	Pronounced and diffuse
33	T.C.	137	Pronounced and hard
35	T.V.	39	Pronounced with heat

* Number 28 was positive on the 75th day for 1 day only. It developed a persistent infection from the 159th day.

The mean breakthrough period in Group 2 was at least 125 days, assuming number 28 to have broken down on the 75th day. If breakdown is taken to be the 159th day, the mean protection period becomes at least 132 days.

TABLE IX
GROUP 3.—ANTRYCIDE METHYLSULPHATE AT 5 MG. PER KG.

Ox number	Trypanosome first noted	Days post treatment	Injection site reaction at the 18th day
14	T.V.	39	Negligible
15	T.V.	47	Negligible
16	—	—	Negligible, died at day 21 post treatment, babesiasis ?
19	—	—	Negligible, died at day 21 post treatment, babesiasis ?
20	T.C.	74	Negligible

Mean breakthrough period in Group 3 was 53 days.

TABLE X
GROUP 4.—ANTRYCIDE PROSALT REVISED FORMULATION

Ox number	Trypanosome first noted	Days post treatment	Injection site reaction at the 18th day
2	T.C.	55	
9	T.C.	54	
11	T.C.	74	
17	T.V.	75	
18	T.V.	54	Swellings not marked in this group
24	T.V.	67	
34	T.V.	53	
36	T.C.	67	
38	T.V.	53	
40	T.V.	53	

Mean breakthrough period in Group 4 was 60 days.

any Novidium remained in the body. Whether or not exposing the animal to adverse climatic and dietary conditions will lead to permanent breakdown or not remains to be seen.

It would appear that retreatment of animals in Groups 1 and 2 with Metamidium at the original dosage rate is effective in those animals removed from tsetse risk.

Retreated animals which remained under tsetse risk were protected for longer periods than they were by the original treatment; this may be due to the fact that risk following retreatment was in the dry season when *G. morsitans* concentrates on the water courses.

Prophylaxis of Metamidium in the dry season will be investigated in a further trial.

In the Antrycide Pro-salt group, Metamidium at 0.5 mg. per kg. was more effective than Novidium at similar dosage. In a curative trial (Kirkby, 1960) results at these dosage rates indicated that, for the trypanosome strain used, the dose for both drugs was more than the minimum curative dose. It was unfortunate that a lower dosage rate of 0.25 mg. per kg. was not used in another group as then the superiority of one drug over the other might have been demonstrated. The present low dosages did, however, demonstrate the superiority of Metamidium.

Acknowledgments.—The writer is indebted to Dr. S. G. Wilson, C.B.E., Chief Veterinary Officer, for permission to publish this paper; and to Mr. T. M. Leach, Deputy Director of the West African Institute for Trypanosomiasis Research, Kaduna, for his advice and help during the absence of the Chief Veterinary Officer.

Reference

KIRKBY, W. W. (1960). I.S.C.T.R. Meeting Jos, N. Nigeria. 1960.

Appendix

Prophylactic periods in animals of Groups 1 to 4, together with details of injection site reactions at the 18th day post treatment.

T.C. = *T. congolense*. T.V. = *T. vivax*.

Corneal Ulceration due to Foreign Bodies Embedded in the Palpebral Conjunctiva

BY
OLAF SWARBRICK
Arundel, Sussex

SUMMARY.—The occurrence of keratitis and corneal ulceration, resulting from spicules of grass embedded in the palpebral conjunctiva of yearling cattle, is described.

History and Occurrence

THIS condition occurred during February in Shorthorn and Hereford yearlings which were being overwintered in a series of loose-boxes. During the previous 6 weeks several animals had been affected with infectious kerato-conjunctivitis, which had been treated by the instillation of intramammary penicillin into the eye. This had initially given very good control, but was eventually found to be no longer effective in preventing serious cases of keratitis, and further attention was requested.

Clinical Symptoms

Some animals obviously had typical infectious kerato-conjunctivitis, but others were affected with a different syndrome. These latter animals had oedematous upper eyelids with excessive lachrymation, accompanied by ulceration and keratitis of the cornea. These ulcers had ragged edges, and were shallow and surrounded by areas of opacity. Infiltration of the cornea with blood vessels such as is seen in infectious kerato-conjunctivitis was not a feature of these eyes. The damaged areas tended to be somewhat elongated and to run from the centre of the cornea upwards towards the scleral border. These animals were obviously in great discomfort. The condition was clinically easily differentiated from infectious kerato-conjunctivitis and more careful examinations of the affected eyes were made. When the upper eyelids were everted ulcers were seen on the conjunctival surface of the oedematous upper eyelids. These varied in size from one mm. to about half cm. in diameter. They were filled with thick yellow necrotic material and from most of them small pieces of oat awn or grass seed protruded, usually at right angles to the conjunctiva. In others these grass spicules were entirely embedded within the necrotic material of the ulcer. Some of these ulcers penetrated very deeply into the submucous tissues of the eyelids, and were undoubtedly the cause of the palpebral oedema. The ulceration of the cornea was a direct result of the continual excoriation caused by the protruding foreign bodies in the palpebral ulcers.

Treatment

This was difficult as many of the pieces of grass were held fast within the tissues of the eyelids by their barb-like construction. Attempts were made to pull these out using small artery forceps and the necrotic material was scraped out of the palpebral ulcers. The bases of these ulcers consisted of granulation tissue from which, in some cases there sprang considerable haemorrhage. The application of oily antibiotic preparations to the affected eyes after this debridement was followed rapidly by the resolution of the keratitis and corneal ulceration, and no permanent damage to the eyes ensued.

Discussion

Although oat awns and grass seeds in the eyes of cattle are a frequent occurrence, the author has never before seen foreign bodies embedded in the palpebral conjunctiva. In most animals the upper eyelid only was involved, and in very few animals was more than one eye affected. These cattle were fed meadow hay and oat straw in racks, which were placed well above their heads, so that they had to reach right up into the hay to feed. The position of these hay racks had been standard practice at this farm for several years and no obvious explanation was found for the sudden occurrence of this unusual eye condition. With difficulty the owners were persuaded to feed the animals hay and straw below shoulder level, and no further cases then occurred.

JURY SERVICE IN SCOTLAND

The Registrar of the Royal College of Veterinary Surgeons informs us that his note recommending veterinary surgeons to make certain that the jury mark is removed from their name on the electoral roll is only applicable to England and Wales.

The Registrar has been advised that the following is the procedure in Scotland: the sheriff clerk prepares from the Register of Electors and the Valuation Roll a list of persons who seem likely to be liable for jury service. To each of these persons the sheriff clerk sends an enrolment of jurors form, which he is asked to complete and return. The form requests information as to the names, ages and professions of members of the addressee's household, and if anyone is shown as a veterinary surgeon his name will not be included in the Jury List. If the name is inadvertently included in the list (for instance, on the basis of incorrect information supplied by someone other than the veterinary surgeon himself, such as a landlord) there are two further opportunities to have it removed. First, the sheriff clerk from time to time sends out forms called Revisal Notices to Juror, addressed to persons who have been placed on the Jury List and who may shortly be called upon to serve. They are given an opportunity to point out any mistake in the Jury List and, in particular, to claim exemption from jury service if they should be entitled to it. The form contains a list of persons entitled to exemption, including veterinary surgeons. If, despite these checks, the veterinary surgeon still remains on the Jury List, and is actually summoned to serve on a jury, an application to the clerk of the court in which he has been summoned to serve will secure exemption on that occasion. At the same time the veterinary surgeon should ask the sheriff clerk—if the latter is not the clerk of the court to which he has been summoned—to remove his name from the Jury List.

News and Comment

SWINE FEVER COMPULSORY SLAUGHTER SCHEME DEFERRED; FREE BRUCELLOSIS VACCINATION TO BEGIN

In a Question in the House of Commons on December 7th, Mr. Percy Browne asked if dates could now be announced for the introduction of a compulsory slaughter policy for swine fever and of a free calf vaccination service against brucellosis. In a written reply the Minister of Agriculture said:—

"In view of the present overriding need for greater economy in Government expenditure, I have regretfully decided that I must defer the introduction of a compulsory slaughter policy for swine fever, which would entail heavy initial expenses, until early in 1963. But we will be starting on May 1st, 1962, with the longer-term, but annually less costly, free calf vaccination service against brucellosis, both in Scotland and in England and Wales."

In a press notice the Ministry observes that the aim is to build up a national herd highly protected against outbreaks of abortion by the vaccination of all female animals during a certain period of calfhood. Vaccination at this time will ensure that the great majority will have ceased to react to the blood (agglutination) test by the time of first calving.

Calves must be vaccinated between the 151st and 240th day of life—that is, during the period of 90 days following the date on which an animal reaches the age of 5 months. It has been found that vaccination, if carried out during this period of calfhood, will in most cases protect against abortion for at least 5 pregnancies. There is little or no advantage to be gained by revaccination.

Calves vaccinated under the official service will be tattooed with a device and date code.

Farmers who wish to use the free vaccination service will be required to present all female calves for vaccination during the time they are eligible for the free service and not to vaccinate any animal (more than 240 days old) except with the agreement of the Ministry. Failure to obtain such agreement may result in withdrawal of the free service.

THE WORLD VETERINARY ASSOCIATION

A brief report of the third meeting of the Permanent Committee, held in Paris on May 18th, 1961, has been released for publication by Professor Jansen, the Secretary-Treasurer. Twenty-four member countries, including the United Kingdom, were represented.

Payment of contributions. Measures to be taken against members who have not paid any contribution or who are in arrears were discussed. It was decided to write to these members, indicating that unless their dues are paid within 6 months they would be suspended from membership.

Future developments of W.V.A. Delegates had been asked to submit the views of their countries on proposals for further developments of W.V.A. Some suggestions had been received which would be considered at a special meeting of the Bureau, to be held in the autumn.

Request of the Organising Committee for the Hanover Congress for a grant from the Congress Fund. Professor Wagener undertook to prepare a budget based on the Congress fee. It was the general view that a fee of $15 would not be excessive if it should prove necessary in order to meet the costs. It was decided that there would be simultaneous translation in 4 languages in 3 of the rooms. It was pointed out that a large proportion of the estimated expenditure would be incurred on this item. No decision was taken about a grant from the Congress funds.

Consideration of Rules. The main outline of the Rules has now been agreed. The Bureau has been empowered to modify the draft rules along lines indicated and to settle by correspondence any modifications on which agreement has not yet been reached.

Applications for Associate Membership

(a) WORLD ASSOCIATION OF VETERINARY ANATOMISTS

An application for recognition of the Association of Veterinary Anatomists had been examined by the Bureau. This Association had 172 members from 37 countries. Professor Bressou, who attended the meeting, intimated that the recommendation of the Permanent Committee that the proportion of non-veterinarians should not exceed 10 per cent. would probably be acceptable. It was decided that this Association would be admitted as an associate member on the understanding that the required modifications of the Statutes would take place.

(b) WORLD SMALL ANIMAL VETERINARY ASSOCIATION

A formal application was received from this Association, whose membership now amounts to 1,500 veterinarians from 8 countries. The Statutes had been examined by the Bureau and were satisfactory. It was decided to accept the W.S.A.V.A. as an associate member of W.V.A.

(c) WORLD ASSOCIATION OF VETERINARY PATHOLOGISTS

Professor Dr. P. Cohrs indicated that this Association had 183 members from 11 countries. As the draft Statutes of this Association had not yet been examined by the Bureau it was decided to defer consideration of accepting this Association until the next meeting of the Permanent Committee.

(d) WORLD ASSOCIATION OF VETERINARY MICROBIOLOGISTS AND IMMUNOLOGISTS

Dr. Willems gave some information about the progress which had been made towards the foundation of this Association.

Film project. (a) Composition of the Film Committee: Sir Thomas Dalling has resigned from the Presidency of the Film Committee and his place has been taken by Professor Schoenaers (Brussels).

(b) Information regarding films: Professor de

Blieck reported that an appendix to the list of veterinary films and films of veterinary interest had been circulated, giving details of 65 new films. It also contained a list of films which had been withdrawn. It was proposed to publish a new catalogue in 1963.

List of diseases of animals. The number of orders which had been received for the above list had been less than 100 copies. It was decided not to publish the list for the time being, but in consultation with Mr. Poole to send a copy of the preliminary list published in 1957 to those members who had ordered a copy.

Organisation of the XVIIth World Veterinary Congress. The preliminary arrangements made for the Congress were discussed and were approved. A draft preliminary programme, approved in principle by the Permanent Committee, had been circulated on May 2nd. It was felt that as there had not been sufficient time for the national committees and associate members to study this programme they should be given the opportunity of sending in their comments, if possible, within the next two months. The members of the Bureau and a representative of the Organising Committee would then meet in the autumn to consider these suggestions.

IODINE 131 IN MILK

Results are now available for measurements, made by the Agricultural Research Council's Radiobiological Laboratory, of iodine 131 in milk during the week ended December 2nd.

The average content of iodine 131 in milk from depots sampled daily has continued to decrease. The values during the past 4 weeks are:—

Week	*uu*c. per litre
November 5th to 11th	117
November 12th to 18th	93
November 19th to 25th	74
November 26th to December 2nd ...	41

The present results give further support to the conclusion that weapon tests which had so far occurred would not cause the annual average level specified by the Medical Research Council to be reached in any part of the country. Measurements of iodine 131 in milk will be made so long as an appreciable quantity is present, but the issuing of weekly statements will be discontinued.

MEETING OF B.V.A. COUNCIL—JANUARY, 1962

The January meeting of Council will be held in the Barnes Hall of the Royal Society of Medicine, 1, Wimpole Street, London, W.1; the date, as already announced, has been changed to January 19th, 1962.

The Royal Society of Medicine is on the corner of Wimpole Street and Henrietta Street, W.1, immediately behind D. H. Evans's store. It is 5 minutes' walk, through Cavendish Square, from the B.V.A. in Mansfield Street.

Arrangements can be made for members to lunch at the Royal Society of Medicine—either a buffet lunch, or a meal in the restaurant at, respectively, 9s. 6d. and approximately 10s. 6d. The restaurant can accommodate up to 30 members, and numbers are more or less unlimited for a buffet lunch, provided *a week's notice is given.* This being so, for this first meeting at the R.S.M., it would be most helpful if members could write to B.V.A. Headquarters giving their wishes as to lunch. Having ordered lunch it is asked that members will not hurry away leaving empty spaces, if the Council meeting should end before lunch.

MILK COMPOSITION IN THE UNITED KINGDOM

In a Question in the House of Commons on December 8th, Mr. Anthony Kershaw asked the Minister of Agriculture whether he had now considered the Report of the Cook Committee on the compositional quality of milk in the United Kingdom. In a written reply the Minister said:—

"The main point to which the Report of the Cook Committee drew attention was the decline in the solids-not-fat (S.N.F.) content of milk in England and Wales over the past 30 years or so. Although the decline has been small, the Government agree that it is desirable to maintain, and if possible to improve, the compositional quality of such an important article of food. I am glad to say that the Milk Marketing Boards and the distributive trade have endorsed this view.

"The Government accept the Committee's recommendation that compositional quality can best be maintained and improved by paying the milk producer according to the compositional quality of his milk. Discussions are at present proceeding on the detailed operation of differential payment schemes to take account of the need to maintain S.N.F. levels."

A statement from the Milk Marketing Board includes the following:—

"The Milk Marketing Board intend to introduce a simple scheme for payment for milk on a quality basis to discourage the producer of milk of poor compositional quality and reward those who produce better milk. The aim is to improve the quality of the nation's milk supply. It is hoped to introduce such a scheme in October, 1962, differential prices to come into force after October, 1963.

"The main criterion will be total solids; this gives an indication of the total food content of milk and will be a fair basis for determining the relative value of milk. One criticism of total solids has been that it would be possible for a high total solids content to be maintained by a high fat percentage, without regard to solids-not-fat. To counter this, milk paid for at standard and premium prices must have contained more than 8.4 per cent. S.N.F. on annual average.

"The Board and the dairy trade have been considering the question of improving the hygienic quality of milk. It has been agreed to introduce as soon as practicable a scheme under which all supplies accepted by buyers under a wholesale contract would be subjected once a month to a standard routine test."

R.A.S.E. BLEDISLOE VETERINARY AWARD TO SIR JOHN RITCHIE

In 1946 the late Lord Bledisloe donated a trophy for competition by counties in England and Wales to encourage the elimination of tuberculosis in dairy cattle. As the eradication of bovine tuberculosis has progressed the number of competing counties has become smaller each year so that the conditions under which the Award was originally made no longer obtain.

In the light of the changed circumstances, the Council of the Society decided to find a new use for the trophy and will in future make an Award to a member of the veterinary profession who has made outstanding contributions to animal health. The Council is advised on this matter by a joint committee of the representatives of the R.C.V.S., the R.V.C. and R.A.S.E.

At the Annual General Meeting of the Governors and Members of the Society held at 35, Belgrave Square on December 6th, the Chairman of the Council, Sir Robert Gooch, presented the Bledisloe cup and medal, which now constitute the Bledisloe Veterinary Award for outstanding individual achievement in the veterinary field, to Sir John Ritchie.

In making the presentation Sir Robert referred to the signal services which Sir John had rendered, first as D.C.V.O. and later as C.V.O. to the Ministry of Agriculture. He drew attention to his wise and stimulating guidance in the field of education and in particular to his chairmanship of an International Conference on Veterinary Education recently convened by FAO. He also referred to his services as a past-President of the R.C.V.S. His most outstanding contribution, however, was undoubtedly the virtual completion of the stupendous task of eliminating bovine tuberculosis from the herds of this country. In view of the interest of the late Lord Bledisloe in this project it was most fitting that Sir John should be the first recipient of the Award in its new guise.

THE XVIITH WORLD VETERINARY CONGRESS, HANOVER, 1963

Members of the British veterinary profession are invited to send suggestions for original papers, not previously published, for consideration by the British national committee. Such suggestions should be addressed to the secretary of this committee, W. G. R. Oates, Esq., Royal College of Veterinary Surgeons, College House, Wright's Lane, Kensington.

It should be noted that either the author or co-author of a paper must attend the congress in person to deliver the paper. Suggestions should be in Mr. Oates's hands not later than January 31st, 1962, and those considered suitable will be forwarded to the organising committee for their consideration.

A meeting of the President and members of the Bureau of the Permanent Committee of the World Veterinary Association, together with members of the Organising Committee and the Programme Committee of the World Veterinary Congress, was held in Hanover on September 25th, 1961. The following outline of the programme for the Congress was agreed.

General Themes (at plenary meetings)

I. HISTORICAL THEMES

(a) 100 years of veterinary congresses.

(b) The development of veterinary science in the last 100 years.

(c) The development of the veterinary profession in the last 100 years.

II. SCIENTIFIC THEMES

(a) Anaesthesia in animals.

(b) Zoonoses and anthropozoonoses.

(c) Metabolic and deficiency diseases.

For each general scientific theme only 3 speakers or papers can be accepted, making a total of 9. The selection of 9 speakers from all proposals received will be carried out by the Scientific Programme Advisory Committee together with the Organising Committee. The British National Committee is now giving this matter its consideration.

Sectional Meetings

It was agreed at the meeting of the Permanent Committee on May 18th, 1961, in Paris that 3 rooms should be equipped for simultaneous interpretation. Sectional meetings will be held on 7 half days. The entire number of sectional meetings equipped for simultaneous interpretation therefore totals 21. In addition the same number of sectional meetings or even more can be provided with consecutive translation if necessary. The sectional meetings will deal with the following: Anatomy (specialist organisation); Physiology, Biochemistry, Pharmacology; Zootechny (Animal Husbandry, Animal Nutrition, specialist organisation); Pathology; Infectious Diseases (bacteriology, virology); Parasitology; Hygiene of animal products (expecting that the international specialist organisation will be affiliated to the World Veterinary Association); Clinical medicine and surgery of small animals (specialist organisation); clinical medicine and surgery of large animals; Avian disease (specialist organisation); Professional affairs and veterinary education.

The Congress will have colour television equipment at its disposal. This equipment will be installed in one of the rooms supplied with simultaneous interpretation and will provide interested speakers with the opportunity to carry out demonstrations on the plentiful patient-material of the Hanover School. Such demonstrations call for special consideration as far as the time is concerned.

Within each section it is intended to select several main sectional subjects ("Schwerpunktthemen"), on each of which a number of papers will be given. Only contributions which are related to these selected main sectional subjects will be accepted for the sectional meetings. By thus concentrating on a few important and topical subjects it is hoped that fruitful discussion will take place.

Specialist Associations

Certain specialist organisations are now affiliated with W.V.A. and they are indicated on page 1417. The specialist organisations have been invited to suggest relevant main sectional subjects and speakers and they will be largely responsible for these sections.

The National Committee are asked to propose main sectional subjects, titles of papers and speakers for the remaining sections.

Contributions for the sectional meetings must consist of original, unpublished material. They are not to exceed 1,500 words. The speaker has 10 minutes at his disposal in which to introduce his printed paper, which should not be read, with a maximum of 850 words. Facilities for the projection of slides (size 5 cm. × 5 cm.) or short films (16 mm.) will be provided. After a lapse of 10 minutes the end of the allotted speaking time will be shown by optical and sound signals. Speakers will not be permitted to exceed the time limit. The 10-minute discourse will be followed by an opportunity for discussion. During the discussion each speaker will be allowed a maximum of 3 minutes. The use of prepared manuscripts or slides will not be permitted during the discussion. All papers must be delivered personally by the author or the co-author.

Free Papers

Valuable contributions, which contain original, unpublished material, but which do not fit into the sectional meetings because they are not related to the selected main sectional subjects, can be submitted as "free papers." For these "free papers" a room with consecutive translation will be available daily.

The British National Committee will be considering main sectional subjects, speakers and titles of papers for the sectional meetings and for the free papers. The selection of speakers will be in the hands of the Scientific Programme Advisory Committee together with the Organising Committee. It must be emphasised that the final selection rests with the Organising Committee of the Congress, in consultation with the Bureau, and only a proportion of papers proposed by national committees can be accepted.

RETIREMENT OF MR. A. M. GRAHAM

Mr. A. M. Graham retired from the post of Regional Veterinary Officer on November 30th, 1961.

On the afternoon of November 22nd a sherry party was held at the South East Region headquarters at Reading, attended by a large and representative group of the Ministry's staff in the Region. Mr. J. W. Pugsley, the Regional Controller, paid a generous tribute to Mr. Graham and presented him, on behalf of his friends in the Ministry, with a pair of field glasses.

Later the same evening, Mr. and Mrs. Graham were entertained in Reading by the whole-time veterinary staff. The 2 guests and 37 of Mr. Graham's colleagues, sat down to dinner under the Chairmanship of Mr. E. G. Morris, who spoke most warmly of the affection the whole-time staff had for Mr. and Mrs. Graham, before calling on Mr. E. T. Camps to propose the toast of the Guests, who were accorded musical honours. Mr. Graham replied and the evening was concluded informally.

Readers will remember Mr. Graham as a most popular and successful President of the B.V.A. in 1952-53. He was the first senior officer of the Ministry's veterinary staff to be elected to this office.

THE R.C.V.S. LIBRARY

In order to have as few books as possible in the post during the Christmas rush, no parcels will be dispatched from the Library after December 15th until after the holiday. The Library will close at 1 p.m. on December 22nd and re-open on Wednesday, 27th, at 10 a.m.

THE LADIES' GUILD

On December 1st, at a meeting called by Mrs. Norman Male, President of the Guild, and held at the Caversham Bridge Hotel, a new Division, the Royal Counties, was formed. The chairman is Mrs. Snodgrass and the secretary, Mrs. Brown. The hon. secretary and the hon. treasurer of the Ladies' Guild attended the meeting. The members of the Royal Counties Division B.V.A. kindly entertained the new Division of the Ladies' Guild to tea after the meeting.

Mrs. Stobo, who is leaving Lincoln, has been instrumental in organising a new Division in Lincolnshire, where she was a collector. The chairman is Mrs. Carmichael, the hon. secretary Mrs. Beaumont and the hon. treasurer Mrs. Duguid.

BRITISH VETERINARY ZOOLOGICAL SOCIETY

At a meeting last July, held by kind permission in the premises of the Zoological Society of London, 37 veterinary surgeons discussed the possibility of forming a new society, whose primary object would be the promotion of veterinary knowledge and skill in maintaining the health and well-being of non-domesticated animals. The precise objects were established as follows: the promotion and advancement in knowledge and skill of those veterinary surgeons associated with the maintenance of the health, treatment and well-being of non-domesticated animals; to promote the proper use of veterinary knowledge and services in collections of non-domesticated animals or by owners of exotic pet animals; to promote the correct housing and conditions of such animals, together with the provision of suitable facilities for the examination and treatment of the animals; to foster research into the husbandry and diseases of non-domesticated animals in captive and wild states; to promote international exchange of veterinary knowledge of non-domesticated animals, and to collect and circulate information, scientific articles and extracts on subjects of interest to members of the Society; to promote interchange of information and the growth of understanding between this and other societies in allied disciplines.

Mr. Oliver Graham-Jones was elected President; Mr. Martin Senior, honorary treasurer-secretary, assisted by an interim committee consisting of Mr. John Dall, Mr. Ian Keymer and Dr. E. C. Appleby.

Subsequently, a joint meeting was held on November 18th, with the B.S.A.V.A. at Bristol, and a proposed constitution drawn up by the interim committee was agreed on. This constitution has been

submitted to the B.V.A. and the new society hopes to become a non-territorial B.V.A. division.

Members of the society must be members of the profession (which, of course, includes members on the Supplementary Register) who are interested in non-domesticated animals, or who attend exotic animals in general practice. The honorary treasurer-secretary, whose address is 85 West Street, Dunstable, Herts., would be pleased to hear from veterinarians who are interested. Arrangements are at present under consideration for a spring meeting, details of which will be published later.

THE REGISTER OF VETERINARY SURGEONS

Mr. John Trevor Faragher, c/o "Four Winds," 6, St. Andrew's Avenue, Harpenden, Herts., was registered in the Commonwealth List on December 8th, 1961, in virtue of the registrable degree of B.V.Sc., of the University of Queensland.

UNIVERSITY NEWS

Edinburgh

The undermentioned candidates have passed the Final Professional Examination for the degree of Bachelor of Veterinary Medicine and Surgery (B.V.M. & S.):—

Blake, George; Gardner, David William; Glickman, Murray Aaron (B.SC. AGRIC.) PURDUE; Jones, Meredydd; Lander, Keith Pascoe; Martin, Ronald Noel; Pearson, Clifford; Robertson, John Fraser; Ross, Ian Carson; Sargeant, John Pilkington; and Williams, David Anthony.

DR. H. H. GREEN

We record with regret the death of Dr. H. H. Green, O.B.E., D.SC. (Glasgow and Pretoria). Senior Research Officer in charge of the Biochemistry Department at the Ministry of Agriculture Veterinary Laboratory, Weybridge, from 1933 to 1953.

He was elected an Honorary Associate of the Royal College of Veterinary Surgeons in 1953, and died, aged 76, on December 4th, 1961.

PERSONAL

Mr. N. C. Fry has resigned his appointment as lecturer in animal health in the University of Ghana. He has accepted a post in FAO and will be joining a technical aid team in Ibadan, Western Nigeria.

Dr. M. N. Menon, who graduated as M.R.C.V.S. in December, 1951, and obtained the Fellowship of the Royal College of Veterinary Surgeons in 1957, has been appointed Director of Animal Husbandry in the State of Kerala.

Births

JENNER.—On December 2nd, 1961, to Eilan, wife of F. H. Jenner, B.SC., M.R.C.V.S., of Little Gowers, Brockenhurst, a son, David Hew.

WILSON.—On November 29th, 1961, to Valerie, wife of George P. H. Wilson, B.V.M.S., M.R.C.V.S., 64, High Street, Weaverham, Cheshire, a son, Robert, brother for Fiona Jill.

Marriage

POULTER—YOUNG.—On November 25th, 1961, at Christ Church, Southgate, London, N.14, David A. L. Poulter, B.VET.MED., M.R.C.V.S., to Jean Helen Patricia Young, M.S.R.

COMING EVENTS

January

17th, 18th and 19th (Wed., Thurs. and Fri.). B.V.A. Committee and Council Meetings in London.

24th (Wed.). LANCASHIRE VETERINARY ASSOCIATION. General meeting at the University of Liverpool, 2.30 p.m.

February

14th (Wed.). BRITISH EQUINE VETERINARY ASSOCIATION. First meeting at the Royal Station Hotel, York, 9.30 a.m.

ADDRESSES OF DISEASE INFECTED PREMISES

The list given below indicates, first the date on which disease has been confirmed, followed by the postal address and local authority.

Anthrax

December 5th, 1961. C. Bailey, Charminster Farm, Charminster, Dorchester, Dorset (Parish: Charminster) (Cattle.) DORSET.

December 5th, 1961. G. A. A. H. Porch, Merryfield Farm, Doulting, Shepton Mallet, Somerset (Parish: Doulting). (Cattle.) SOMERSET.

December 5th, 1961. T. & W. Fry, Youlton Farm, Warbstow, Launceston, Cornwall (Parish: Warbstow). (Cattle.) CORNWALL.

December 8th, 1961. B. S. Tabbey, Downe Hall Farm, Low Hill, Roydon, Harlow, Essex. (Cattle.) ESSEX.

December 8th, 1961. R. Muirhead, Greentowers Farm, Lanark, Lanarkshire (Cattle.) LANARKSHIRE.

December 8th, 1961. W. McDonald, Milton of Conon, Carmyllie, Arbroath, Angus (Parish: Carmyllie). (Cattle.) ANGUS.

December 8th, 1961. E. W. Pepper Ltd., Brook Orchard Farm, Bassingbourn, Royston, Herts. (Parish Bassingbourn). (Swine.) CAMBRIDGESHIRE.

December 8th, 1961. G. C. Cowie, Gold Straw Farm, Little Ness, Neston, Wirral, Cheshire. (Cattle.) CHESHIRE.

December 11th, 1961. J. T. Ryder, Fairfield Farm, Aldwark Alne, York (Parish. Aldwark). (Cattle.) YORK, NORTH RIDING.

December 11th, 1961. A. Leech, Dairy House Farm, Oakmere, Northwich, Ches. (Parish: Oakmere). (Cattle.) CHESHIRE.

December 11th, 1961. G. Griffiths & Son, Newton Hall Farm, Newton, West Kirby, Wirral, Cheshire (Parish: Hoylake cum West Kirby). (Cattle.) CHESHIRE.

Fowl Pest

December 5th, 1961. Griffiths & Barraclough, Little Hallingbury Park, Bishop's Stortford, Herts. Disease at: Corringales Farm, Hatfield Heath, Bishop's Stortford, Herts. ESSEX.

December 5th, 1961. E. Redman, Highfield Poultry Farm, Bubwith, Selby, Yorks. Disease at: Manor Farm, Breighton, Selby Yorks. YORK, EAST RIDING.

December 5th, 1961. S. C. Bennett, Yew Tree Cottage, Bockhampton Road, Christchurch, Hants. Disease at: Meadow Farm, Burton, Christchurch, Hants. HAMPSHIRE.
December 5th, 1961. Mrs. L. A. H. Austin, Orchard House, Stanton, Bury St. Edmunds, Suffolk. WEST SUFFOLK.
December 6th, 1961. Mrs. J. W. Beevis, Post Office Cottages, Knettishall, Diss, Norfolk. WEST SUFFOLK.
December 6th, 1961. G. T. Paine, The Grange, Lydd, Kent. Disease at: Fortyacres Farm, Lydd, Kent. KENT.
December 6th, 1961. F. C. Lines, Blue Pump Cottage, Roydon, Diss, Norfolk. NORFOLK.
December 7th, 1961. R. Vines, Brook Villa Farm, Bentham, Cheltenham, Glos. GLOUCESTERSHIRE.
December 7th, 1961. J. W. Barnett, 16, Harwall Lane, King's Langley, Herts. HERTFORDSHIRE.
December 7th, 1961. Grinnel, Blenheim Villa, The Reddings, Cheltenham, Glos. GLOUCESTERSHIRE.
December 7th, 1961. Minns Bros; High House Farm, Wreningham, Norwich, Norfolk. NOR 90W. NORFOLK.
December 7th, 1961. F. D. Davison, Church Farm Cottage, Syleham, Diss, Norfolk. EAST SUFFOLK.
December 7th, 1961. Mrs. F. Westbrook, 82, Whitehayes Road, Burton, Christchurch, Hants. HAMPSHIRE.
December 7th, 1961. Mrs. G. M. Moore, 7, Rook Street, Cottenham, Cambridge. CAMBRIDGESHIRE.
December 7th, 1961. O. R. Oakes, Breckey Ley, Nowton, Bury St. Edmunds, Suffolk. Disease at: Nowton Lodge Farm, Newton, Bury St. Edmunds, Suffolk. WEST SUFFOLK.
December 7th, 1961. J. W. Rush, Mill House, The Common, New Buckenham, Norwich, Norfolk. NOR 04X. NORFOLK.
December 7th, 1961. D. Bailey, Park Common, Kenninghall, Norwich. NOR 06X. NORFOLK.
December 8th, 1961. G. Collins, Farmers Arms, Mile Road, Carleton Rode, Norwich, Norfolk. NOR 03X. NORFOLK.
December 8th, 1961. W. J. Stannard, Broad View, Wetheringsett, Stowmarket, Suffolk. EAST SUFFOLK.
December 8th, 1961. R. G. E. Mower, Mill Farm, Market Weston, Diss, Norfolk. WEST SUFFOLK.
December 8th, 1961. P. & R. T. Handover and A. R. Murrell, Rose Acre, Bedmond Hill, Hemel Hempstead, Herts. HERTFORDSHIRE.
December 8th, 1961. R. Worsley, The Paddocks, Low Catton, Stamford Bridge, York. YORK, EAST RIDING.
December 8th, 1961. C. Wilding, Poplars Farm, Shurdington, Cheltenham, Glos. GLOUCESTERSHIRE.
December 9th, 1961. Mrs. T. Mathews, Bank View Farm, Bamfurlong, Cheltenham, Glos. GLOUCESTERSHIRE.
December 9th, 1961. A. Smith, Breighton House, Breighton, Selby, Yorks. YORK, EAST RIDING.
December 9th, 1961. H. W. Hall, Beech Cottage, New Buckenham, Norwich, Norfolk. NOR 04X. NORFOLK.
December 9th, 1961. S. G. Wombwell, Hill House Farm, Great Eversden, Cambridge. CAMBRIDGESHIRE.
December 10th, 1961. Laflin Bros., Hollow Road Farm, Fornham St. Martin, Bury St. Edmunds, Suffolk. WEST SUFFOLK.
December 10th, 1961. V. Townsend, Drizen House Farm, Shurdington, Cheltenham, Glos. GLOUCESTERSHIRE.
December 10th, 1961. Eccles Farms Ltd., Quidenham, Norwich. NOR 07X. Disease at: Tech. Site, Snetterton, Norwich, Norfolk. NOR 10X. NORFOLK.
December 11th, 1961. J. F. Garton, Blunts Lane, Whittlesey, Peterborough, Northants. ; Disease at: Fenlands Hatchery, Blunts Lane, Whittlesey, Peterborough, Northants. ISLE OF ELY.
December 11th, 1961. L. C. Clears, Spring Farm, Thelnetham, Diss, Norfolk. WEST SUFFOLK.
December 11th, 1961. L. Dungar, 22, High Street, Whittlesey, Peterborough, Northants. ISLE OF ELY.
December 11th, 1961. J. H. L. Musker, Estate Office, Rushford, Thetford, Norfolk. WEST SUFFOLK.

Swine Fever

December 5th, 1961. F. G. Price, Rectory Farm, Rectory Lane, Rock Kidderminster, Worcs. WORCESTERSHIRE.
December 5th, 1961. P. A. Mason, Riverlands Farm, Gunthorpe, Nottingham. NOTTINGHAMSHIRE.
December 5th, 1961. R. Pearce, 52, Park Road, Guiseley, Leeds, Yorks. Disease at: Park View Piggeries, Guiseley, Leeds, Yorks. YORK, WEST RIDING.
December 5th, 1961. G. A. Kohn, Beaudesert Park, Henley-in-Arden, Solihull, Warwicks. Disease at: Impsley Farm, Henley-in-Arden, Solihull, Warwick. WARWICKSHIRE.
December 6th, 1961. R. L. Holtby, Dowthorpe Hall, Skirlaugh, Hull, Yorks. YORK, EAST RIDING.
December 6th, 1961. G. T. Sadler, Old House Farm, Crowle, Worcester. WORCESTERSHIRE.
December 7th, 1961. S. Oakes, Woodbine Cottage, Longford, Derby. DERBYSHIRE.
December 8th, 1961. G. E. Deighton, 4, Hambleton Road, Harrogate, Yorks. YORK, WEST RIDING.
December 8th, 1961. E. Paling & Son, Cow Close Farm, Unstone, Sheffield, Yorks. DERBYSHIRE.
December 8th, 1961. H. J. Bomford, Snap Farm, Woodsend, Aldbourne, Marlborough, Wilts. WILTSHIRE.
December 11th, 1961. J. E. Walker, Oak Farm, Catherine-de-Barnes, Solihull, Warwicks. WARWICKSHIRE.
December 11th, 1961. B. Reed, Hope Farm, Sandhutton, Thirsk, Yorks. YORK, NORTH RIDING.
December 11th, 1961. H. Garside & Son, Highfield Farm, Slaithwaite, Huddersfield, Yorks. YORK, WEST RIDING.
December 11th, 1961. E. Harland, The Bungalow, Burton Pidsea, Hull. Disease at: The Chestnuts, Burton Pidsea, Hull, Yorks. YORK, EAST RIDING.
December 11th, 1961. F. Seyffert, The Caravan, Ladybridge Well, Bedale, Yorks. YORK, NORTH RIDING.
December 11th, 1961. E. J. Rolfe, Hall Farm, Laxfield, Woodbridge, Suffolk. EAST SUFFOLK.
December 11th, 1961. D. F. Mayhew, The Hall, Pettaugh, Stowmarket, Suffolk. EAST SUFFOLK.
December 11th, 1961. Horvat Farms Ltd. (S. N. Horvat), Stanway Green Farm, Worlingworth, Woodbridge, Suffolk. Disease at: Manor Farm, Wilby, Diss, Norfolk. EAST SUFFOLK.
December 11th, 1961. A. Bogges, Whitefields Farm, Wetley Rocks, Stoke-on-Trent, Staffs. STAFFORDSHIRE.
December 11th, 1961. L. R. Davidson, Marlowe Farm, Leintwardine, Craven Arms, Salop. HEREFORDSHIRE.

JANUARY MEETINGS OF B.V.A. STANDING COMMITTEES AND COUNCIL

Tuesday, January 16th, 1962

5 p.m. Finance sub-committee.

Wednesday, January 17th, 1962

10 a.m. Veterinary State Medicine Committee.

11.30 a.m. Small Animals Committee.

2.15 p.m. Home Appointments Committee.

3.45 p.m. Parliamentary and Public Relations Committee.

Thursday, January 18th, 1962

10 a.m. Farm Livestock Committee.

2.15 p.m. General Purposes and Finance Committee.

Friday, January 19th, 1962

10 a.m. Meeting of Council at the Royal Society of Medicine: 1, Wimpole Street, London, W.1.

(Please see page 1418, col. 1.)

Letters to the Editor

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

SCIENTIFIC

The Development of Hypomagnesaemia in Lactating Ewes

Sir,—During the course of a long-term investigation into the feed intake and performance of grazing ewes, an opportunity was presented to investigate the development of hypomagnesaemia in lactating ewes. Twenty-three Clun ewes were grazing a rather bare pasture, of approximately 10 acres; after lambing in January, 1961, the ewes comprised 2 groups, namely Group A which received a daily supplement of 700 g. of concentrates for the first 50 days of lactation, and Group B in which the grazing was unsupplemented. Individual records were being kept of the changes in dry matter intake, measured by the method described by Owen (1961), milk yield and live-weight.

The development, on February 20th, 1961, of hypomagnesaemic tetany in one ewe and its subsequent death initiated a study of the serum magnesium level in the remaining animals. Samples of blood were taken from both groups on 4 occasions, twice during the period while concentrates were fed to Group A and twice after supplementary feeding had ceased; and the mean serum magnesium levels for the 2 periods are shown in Table I. During the period of concentrate feeding, Group A had the higher mean serum magnesium level and the results showed that 10 of the 11 ewes in this group had a serum magnesium of 2.0 mg. per cent. or over, whilst in 9 of the 12 ewes in Group B the serum Mg. was under 2.0 mg. per cent. There was little difference in the serum magnesium level of the 2 groups after concentrate feeding had ceased.

When individual records were examined, it was found that those ewes with a low level of serum magnesium also showed a marked decline in dry matter intake and milk yield, and a greater than average loss of bodyweight. Table II shows the results for the 3 ewes in which the magnesium fell to a level below 1.5 mg. per cent. together with mean values for the other ewes. In 2 animals, the serum magnesium fell to 0.8 and 0.9 mg. per cent., but only one, ewe R112, developed tetany and died. Ewes J41 and J44 were normal on clinical examination although the changes in dry matter intake, milk yield, and bodyweight were similar to those shown by ewe R112. These changes were especially marked in the case of J41, which was a ewe with a high initial milk supply; the daily oral administration of magnesium to this animal was followed by an increase in serum magnesium, a recovery of dry matter intake, raised milk yield, and reduced rate of weight loss.

The limited data suggest that a reduced dry matter

TABLE I
THE MEAN SERUM MAGNESIUM LEVELS IN TWO GROUPS OF LACTATING EWES

Group	Number of sheep	Diet	Date of sampling	Mean serum Mg. ± S.E. mg. per cent.	Diet	Date of sampling	Mean serum Mg. ± S.E. mg. per cent.
A	11	Grazing and concentrates	23.2.61 3.3.61	2·3 ± 0·10 2·3 ± 0·12	Grazing Grazing	24.3.61 20.4.61	2·0 ± 0·13 2·0 ± 0·09
B	12*	Grazing	23.2.61 3.3.61	1·6 ± 0·16 1·8 ± 0·12	Grazing Grazing	24.3.61 20.4.61	2·0 ± 0·11 1·9 ± 0·09

* Including a ewe from which only a single blood sample was obtained prior to death from hypomagnesaemic tetany.

TABLE II
THE DRY MATTER INTAKE, MILK YIELD AND WEIGHT LOSS DURING THE FIRST 6 WEEKS AFTER LAMBING IN 3 EWES IN WHICH THE MAGNESIUM LEVEL FELL BELOW 1·5 MG. PER CENT. WITH MEAN VALUES FROM THE OTHER EWES FOR COMPARISON

Group	Ewe Number	Minimum serum Mg. mg. per cent.	Daily dry matter intake kg. per day	Maximum daily milk yield kg.	Minimum daily milk yield kg.	Daily weight loss kg. per day
B	R112*	0·8	0·61	1·87	0·31	0·52
B	J41	0·9	0·88	3·43	0·82	0·70
B	J44	1·3	1·08	1·87	1·02	0·46
B	Mean for remainder of group ± S.E.	Above 1·5	1·32 ± 0·07	1·94 ± 0·11	1·01 ± 0·07	0·26 ± 0·03
A	Mean ± S.E.	Above 1·5	1·63 ± 0·08	2·33 ± 0·17	1·41 ± 0·11	0·16 ± 0·03

* Data calculated up to death 4 weeks after lambing.

intake may be a factor in the aetiology of some cases of hypomagnesaemia in lactating ewes. Furthermore, it appears to be an individual phenomenon since most of the ewes grazed the same pasture at the same time and, even without supplementation, did not show the marked decline in dry matter intake. The causal relationships involved are not clear and further work is required to determine which change occurs first.

Yours faithfully,

J. B. OWEN,
K. B. SINCLAIR.
Department of Agriculture (Animal Husbandry),
University College of Wales,
Aberystwyth.

December 7th, 1961.

Reference

OWEN, J. B. (1961). *Nature, Lond.* **192**. 92.

GENERAL

A History of the British Overseas Veterinary Services

Sir,—In your leading article on November 11th you referred in general terms to some of the problems peculiar to the British overseas veterinary services. May I, as one who served in the Indian Empire, enlarge upon some aspects of the circumstances in which the administration operated? What follows mostly concerns the events of the quarter century before India and Pakistan achieved self-government, and may I say immediately that, in my belief, preparation for self-government might have been made soon after the end of the First World War, and that, in retrospect, it is hard to defend some of the dragging of feet on the part of those who might have been more enterprising. If the services had been efficient over the long period during which they were responsible for their respective duties, particularly in the formative years of this century, there should have been sufficient experience and talent in the Indian and what is now the Pakistani populations, for them to have succeeded to office a couple of decades before 1947. If there were not sufficient talent and ability available the blame could be levelled at the state of the services, at least during the first quarter of this century. A great deal more might have been done to ensure that far more Indians were given opportunities to get higher veterinary training overseas than was actually done. The number with such opportunities up to the end of the First World War was so small as to be negligible.

Before and during my time, the administration of India, apart from the Army, consisted of the Federal Government, the Government of India under the Viceroy; 12 provinces (3 of them Presidencies, a senior status deriving from the earlier settlement of the country), each under a Governor; and the Indian States. The Government of India and the provinces comprised British India. The Indian States were under an entirely separate set of administrations with control from the Viceroy but the Indian Civil Service had nothing to do with them, apart from very few of its members who held appointments there.

Few realise the extent to which the provincial governments were autonomous. The civil services were special to each, and the officers were not ordinarily transferable.

In what follows I refer entirely to the senior civil services, the personnel of which were recruited in London by the Secretary of State for India, and who within this period were almost entirely European subjects.

Most of them spent their entire service within one province. In the case of services with a very small cadre of "Secretary of State" officials, such as the veterinary service which had one, two or at the most about three people within a province, transfers were far more frequent; this was because of the need to allow for leave vacancies, illness and so on, with small numbers barely sufficient to go round.

A feature of the Indian civil services that may not have been generally understood was the curious mixture of military officers permanently on civil duty in some branches, carrying promotion by military rank on a time-scale. I think that posting to civil employ ceased quite early in this century, but as these officers came in when very junior, they were in evidence for many years. A quite unusual feature was that the senior medical officials were all military officers. The Indian Medical (a magnificent service) was thus entirely military, and its medical staff were recruited in exactly the same way as for the Royal Army Medical Corps. Most of them spent only a short time on military duty and then passed for the rest of their service to civil life, promotion in military rank proceeding regularly.

It was in somewhat similar circumstances that the early heads of the veterinary departments were, almost without exception, military officers, seconded for civil work. This explains the constant mention of military veterinarians in the accounts of the history of the Indian services. Many were giants in their profession. After 1902 it was decided that, for the future, only civilians would be recruited for the civil veterinary service.

The Indian States were not usually efficient in the sense understood in more developed countries; their livestock health services were, in many cases, quite deficient. In a number there was a veterinary cadre; in a few there were efficient departments, men having been sent to qualify at an Indian veterinary college though they did not always remain in such employment on return. On the whole, however, nature tended to be left to take its course in animal diseases.

If I may be allowed to reminisce, the following may be taken as an example of the need for professional guidance. I was sent to a State to present a report on the health of the camels of that State's baggage transport department. On arrival there was some difficulty in finding the 4 or 5 trained veterinarians, said to be in the State service. After a couple of days they were traced, having acquired far more lucrative appointments in entirely different capacities! The camel men were paid 4 rupees a month and may have got unstated perquisites; they

fed and clothed themselves and were allowed to use the surplus camels' milk for themselves and their families. The camel calves got very little milk. A system of very close hobbling was used when the camels were out browsing, a custom I had not seen previously except for some special reason; this was to save the men the trouble of moving to any extent when in charge. As a consequence the animals' limb development was often defective and permanent injury to limbs prevalent. The animals were in wretched condition all round. All this had been accepted as inevitable. I never heard what happened as a result of my recommendations, but would have been surprised if much was done.

In spite of the criticism about delay in "Indianisation," the British handed over well organised, well housed, and well staffed veterinary departments to India and Pakistan in 1947. In each province there were numbers of properly built veterinary hospitals, with permanent personnel, including often a professional staff touring regularly the outlying areas and dealing with out-patient work, preventive inoculation, etc. Indian veterinary graduates very rarely set up in private practice; almost all sought pensionable government posts.

If the publication of the History were to serve as a stimulus to ex-officers of the services to write up recollections which came back to them a lot of most useful additional history might be accumulated. This could possibly comprise an additional volume.

Yours faithfully,
W. A. POOL.

Ingleby,
Effingham Road,
Surbiton,
Surrey.
November 16th, 1961.

Experiments on Animals: Home Office Inspectors

Sir,—It is very desirable that one or more of the Home Office Inspectors should be veterinary surgeons. This view has long been held by animal-protectionists and members of the profession. Unfortunately, however, it is extremely difficult to find suitable veterinarians who are willing to undertake the work. Vacancies for two new Inspectors have been advertised, and another one is likely to arise next year. I have been trying to persuade one or two members of the profession who are particularly well qualified to apply for these posts, but have been quite unsuccessful. Can any of your readers help?

Yours faithfully,
C. W. HUME,
Secretary-General of UFAW.

The Universities Federation for Animal Welfare,
7a Lamb's Conduit Passage,
London, W.C.1.
November 30th, 1961.

A Clinical Note on Johne's Disease

Sir,—Last week I examined a Friesian heifer, aged 1 year 10 months, which was 3 months pregnant. There was almost complete inappetence and colic was evidenced by stretching of the forelegs, and kicking at the abdomen by the hind legs, accompanied by intermittent unsuccessful attempts at defaecation.

Rectal temperature was 102°F.; rumenal movements were infrequent and weak. Rectal examination showed only very slight peristalsis. The rectum was ballooned, and contained only a small quantity of faeces which was firm but had a fetid odour.

Having considered these symptoms and also the history, I expressed the opinion that strangulation of the intestine had occurred and recommended immediate slaughter for salvage.

Post mortem showed that no such strangulation had, in fact, occurred. The mucous membrane of the whole intestine showed the typical lesion of Johne's disease.

Inappetence during a week or ten days prior to diarrhoeic symptoms is fairly common in cases of Johne's disease. However, I have never seen or heard of a case exhibiting colic and I do not recall having seen it recorded in the literature. Hence I feel that this case may prove of interest to practitioners in large-animal practice.

Yours faithfully,
W. J. HANDCOCK.

7 Church Street,
Crewkerne,
Somerset.
December 7th, 1961.

Experience with a Tranquilliser

Sir,—May I add my experiences with acetyl promazine maleate to the interesting comments of Messrs. Van Laun, Nettleton and Japp? (*Vet. Rec.*, December 2nd).

Initially, dogs were used to compare the effects of this compound with 2 other phenothiazine derivative tranquillisers. Acetyl promazine was used on 40 occasions using the same 11 dogs; by mouth (16 times), intravenously (12 times) and intramuscularly (12 times). In addition barbiturate potentiation was studied on 3 dogs 2 hours after premedication. The potentiating factors for the 3 dogs were x 1.7, x 1.8 and x 2.2.

By the 3 routes the sedative effect was predictable and no undesirable side effects were noticed. For a comparable sedative effect the dose of acetyl promazine required was only one half to one sixth that of the 2 other tranquillisers. Dogs that were deliberately overdosed showed varying degrees of posterior incoordination only. When a sedative effect was required by the oral route comparable to that produced by injection, then dosing of the fasted dog was found necessary. These results on fasted or fed dogs were repeatable for the other 2 tranquillisers. Dosing on a full stomach produced variable and clinically unsatisfactory results.

Barbiturate potentiation was also studied in adult Large White sows. One hour or more after premedication thiopentone sodium was administered fast intravenously. When the barbiturate dose was not reduced anaesthesia was markedly deepened and

lengthened. But for a comparable depth of anaesthesia the amount of thiopentone required was approximately halved, *i.e.* the potentiating factor was found to be about x 2.

In sheep the indications for use seem more limited. Dorset Horn and Clun Forest rams were effectively sedated and in common with bulls and horses the penis became sufficiently relaxed to allow full withdrawal and examination. This facility might be used to recover virtually uncontaminated semen samples from rams, as has been suggested for bulls.

Acetyl promazine has also been used at Thurgarton on dairy cows and bulls, and heavy riding horses by the intramuscular and intravenous routes. Penis relaxation was always present to varying degrees and all animals became more tractable. Ayrshire cattle showed some relaxation of the third eyelid as dogs always do.

The unexpected recumbency of cattle mentioned by Messrs. Van Laun, Nettleton and Japp has not been encountered here but lengthy surgical interferences have not been attempted. Because acetyl promazine premedication potentiates the action of local anaesthetics it would seem advisable to use a reduced dose by the epidural route for posterior anaesthesia. The particular advantage of acetyl promazine over similar compounds appears to be its very low dose rate and consequent small volume of solution necessary. This becomes of paramount importance when dealing with the unmanageable animal.

It is intended to publish at a later date these findings in full, and the result of an extensive clinical trial with dogs.

Yours faithfully,
B. S. COOPER.

Boots Pure Drug Co. Ltd.,
Research Department,
Veterinary Science Division,
The Priory,
Thurgarton,
Notts.
December 11th, 1961.

Antibiotic Treatment and Its Effect on Anthrax Immunisation

Sir,—It has been established beyond doubt that bovine animals vaccinated with a reliable anthrax vaccine remain immune for at least 9 to 12 months. Recently one of us inoculated a cow with an anthrax vaccine shown by laboratory assay to be adequate; yet one month after inoculation, at a time when peak immunity should have developed, the animal died of anthrax. This was a matter of concern because the batch from which the bottle of vaccine was taken had been shown, by laboratory assay, to be well above the minimum potency required. Moreover, a repeat laboratory assay on the residual contents of the actual bottle of vaccine used for immunising the animal showed that it was of adequate potency.

After a thorough consideration of the circumstances, it was recalled that the cow suffered from metritis and was treated within 3 days of inoculation with 1.79 gm. streptomycin sulphate, 1.7 gm. dihydrostreptomycin and 3 million units of procaine penicillin, followed on subsequent days by treatment with 3 million units of penicillin together with a total of 150 gm. of sulphapyridine.

The anthrax bacillus is highly susceptible to both the antibiotic and the chemotherapeutic agents used and these would undoubtedly have rapidly sterilised both the inoculation site and any other sites which the attenuated anthrax vaccine organisms had reached. Since the degree of immunity elicited by this type of vaccine depends entirely on the extent to which the inoculum multiplies it is reasonable to conclude that the administration of the antibacterial agents was responsible for the failure of the cow to develop sufficient immunity.

Since antibotics are widely used in feedstuffs as well as for therapy, the possibility that these might impair the action of living vaccines should be borne in mind.

Yours faithfully,
L. A. LEE.

Leighton House,
Uttoxeter,
Staffs.

A. R. M. KIDD.

Wellcome Foundation,
London.

M. STERNE.

Wellcome Foundation,
Beckenham,
Kent.
December 8th, 1961.

DISEASES OF ANIMALS ACT, 1950—GREAT BRITAIN

Summary of Returns of Confirmed Outbreaks of Scheduled (Notifiable) Diseases

Period		Anthrax	Atrophic Rhinitis	Foot-and-Mouth	Fowl Pest	Sheep Scab	Swine Fever
16th to 30th November, 1961		18	—	—	62	—	39
Corresponding period in	1960	10	—	91	127	—	63
	1959	13	—	4	398	—	63
	1958	4	—	—	25	—	39
1st January to 30th November, 1961		219	—	103	1,054	—	997
Corresponding period in	1960	185	1	234	1,817	—	1,131
	1959	237	2	13	1,377	—	1,196
	1958	143	5	116	667	—	1,146

Correction. In the return for the period 1st to 15th November 1961 the number of outbreaks of Anthrax confirmed 1st January to 15th November 1961 should read 201 not 207.